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Electrical World

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THIS portrait of Mr. Lincoln by Wright was painted from life in 1860 just before his election to the Presidency. It is considered the finest likeness of him as he is remembered by his friends in Springfield. This year at the annual meeting of the Lincoln Centennial Association on February 12th, the address will be of particular interest to all electrical men as it will be delivered by DR. MICHAEL PUPIN, *President of the American Institute of Electrical Engineers.*

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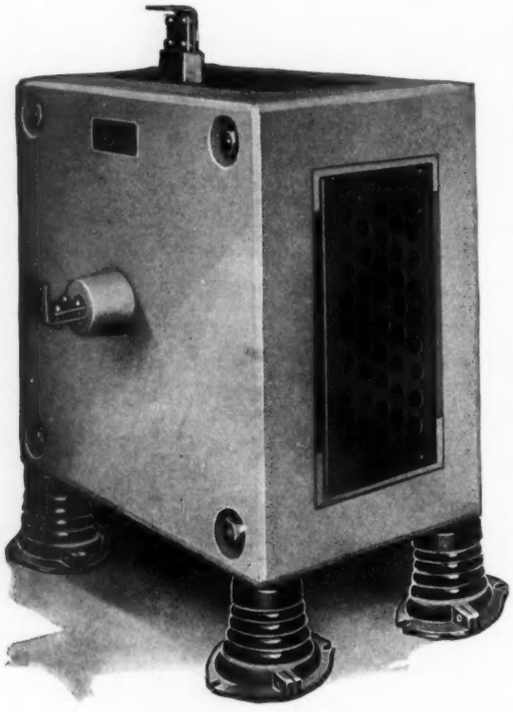

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Electrical World

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Editor

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Utilities Raise Large Sums at Low Rates

A NEW record was established by the light and power utility companies in January. They raised a total of $168,233,242 in the money markets as compared with $83,400,000 in January a year ago. Yet this large sum is small when it is considered that $5,058,395,000 of capital has been raised by these utilities since 1920. Last year, in March, the record for security issues reached a peak, with slightly more than $143,000,000, so the new year starts on an unprecedented financial scale. The utilities are putting this money to work to increase their facilities for service, and it is a good omen that their credit is such that they can raise money at very reasonable rates.

In 1920 the average yield of these securities was 8 per cent. The rate decreased gradually until it was about 6 per cent in 1925. The new issues in January maintain the same low-yield rate, but some outstanding securities were issued at remarkably low rates. The Commonwealth Edison Company of Chicago, for example, issued $15,000,000 in 30-year 4½ per cent gold bonds to yield 4.95 and the Buffalo General Electric Company issued $10,000,000 in 30-year 5 per cent gold bonds to yield 5.05. Several examples are found of preferred stock at 6 per cent and bonds at 5 per cent.

The utilities of this country have at last established an enviable credit position in banking channels. They can now secure money on terms as low as any other bidder and have no trouble in raising the required capital for extending and building their systems to give better service to their customers. These advantages in finance, however, also place heavy responsibilities on utility executives to see that money is spent wisely and investors are fully protected. A Federal Reserve bank is bound to display an extreme conservatism that is not always requisite on the part of a local village bank.

No Place for Absentee Landlordism in the Power Industry

THE steady drift toward centralization in the management and financing of electric light and power companies is naturally affecting the intergroup relations of the electrical industry in many ways and causing no small concern. For any concentration at the headquarters of holding companies of control in the purchasing of equipment and supplies for distant properties is bound to bring radical changes in established practice in the distribution and sale of many products. Moreover, the direction of executive policy from the home office, while undoubtedly of great benefit in improved efficiencies made possible in engineering, in financing and in operation, offers grave danger if it be allowed to interfere with the intimate personal responsibility of the local management to the local public.

Executive Manager Aylesworth of the National Electric Light Association sounded a good note at the recent conference of the operating managers of the Fitkin organization when he said: "We must have no absentee landlordism in the electric power industry. It won't go in this country. Men in the field must be able to give 'yes' or 'no' to the people of the communities they serve, and this local authority and responsibility must be in the hands of men of intelligence and initiative who are free to act unhampered by control from New York or Chicago."

That is sound counsel, and it is founded on a basic principle that applies to the trade and industry relationships of the local central-station company as well as its contacts with the public. The confidence and sympathetic understanding of the other branches of the electrical industry of the community is a mighty asset, as many a utility has found in times of stress, and it should not be lightly cast away. Besides, the difficulties in obtaining men of outstanding executive ability to head local companies at prevailing salaries will increase in direct proportion as these local managers are shorn of their independent authority and as their initiative is curbed.

The Passing of Joseph B. McCall

WORK thirteen months in eleven if you will but rest the twelfth was the advice which Joseph B. McCall always gave but never followed until it was too late. A pioneer in the electrical industry though still young, he was smitten in the prime of life and for three years, until death finally overtook him, was compelled to sit on the side lines watching his "gang," as he loved to call them, carry on the work he started. And how they loved to work for him! It was a sad day for Philadelphia, and sadder still for the officers and employees of the Philadelphia Electric Company, when the news came from Atlantic City that the head of the company was dead. They felt as though something had passed out of their lives. To the industry he was one of the "big five," but to the men and women in the Philadelphia Electric Company Joseph B. McCall was the personification of all that was noble, grand and good. He was intensely human, one of the most human individuals that the electric light and power industry has ever known, and, being human, he was likable and to those who labored beside him adorable.

Brought up under the tutelage of men of the old school such as Martin Maloney and William L. Elkins in the business of street lighting by the use of gas lamps, McCall was taught at a malleable age to depend on his own resources. Such training, while severe, gave him confidence and that twin virtue for which he was noted, fearlessness. The switch-over to electric lighting was a natural and logical evolution. Maloney started the Pennsylvania Heat, Light & Power Company in 1895, with young McCall as his secretary. Then followed an active period of consolidation with the Edison Company and a group of six other local companies known as the electric trust. In 1897 ten other com-

panies were added to the original seven, and Maloney, who still dominated the situation, made McCall, then only twenty-seven years old, president. Thirty-two companies in all were finally consolidated into the Philadelphia Electric Company, but the financial structure was weak in that $35,000,000 in trust certificates was issued in exchange for the stock of consolidated companies. This lien on the company prevented its being mortgaged to obtain capital for further operation, and Mr. McCall undertook the task of getting back these certificates and replacing them with bonds. This was perhaps his greatest business achievement. He placed the company on a firm financial foundation, resulting in the $160,000,000 capital of today.

But how was it that Joseph B. McCall, with no special knowledge of finance, became such a leader of his time and was so successful early in life? He believed that men should be encouraged and developed. As a member of the welfare committee of the National Electric Light Association, he made a study of employees' relations, and anything he recommended to the national association he first practiced in his own organization. He also believed with all his heart that after long years of work and loyal service any man retiring from the company's service deserved an annuity for the rest of his life.

McCall trusted men and they had confidence in him. On such principles he surrounded himself with a loyal organization, to whom he was always faithful. The old-timers he called by their first names and visited regularly in their homes. At social and other functions held in places of public assembly he would, when a box was offered to him, invariably reply: "No, thanks. I'd rather sit down with my gang." That was characteristic of McCall, and that was why his organization loved him, his friends were proud of him and the electric industry honored him.

Metermen as Consultants on Rates

AT A RECENT meeting of metermen the suggestion was made that the meter departments be called in to help the rate-making and contracting departments in their work whenever metering is involved. It was declared by several in attendance that some contracts are put up to the meter departments which are nearly impossible to meter or which can be metered only with unnecessary trouble and expense. If this situation exists generally, are not the commercial and rate-making departments of utilities overlooking an opportunity by not considering how the meter department can help them in some of their problems? In any event, it is quite probable that if such departments outlined their purposes or requirements, the meter department could suggest how the metering could be handled most conveniently and with the least expense. Then the rate or contract could be built around this method.

Two phases of rates and contracts offer excellent subjects for such co-operation—demand and power factor. Measurement of both involves considerable expense at present, if not inconvenience or even impossibility. It thus becomes a burden on small installations. No doubt, if the economic requirements of rates and contracts are pointed out to meter departments, they can, in co-operation with the engineering department, suggest methods which will serve all desired purposes, and serve them more economically and conveniently than now. However, since metermen make this suggestion, they must and doubtless will prepare themselves to serve in this advisory capacity if called.

Overvoltages in High-Tension Networks

IN RECENT years there has been a notable tendency among transmission engineers toward the elimination of lightning arresters and other forms of protection against high-voltage surges in the case of lines whose voltage values are well within the upper range. Increasing knowledge as to the values of voltage rises due to abnormal conditions has led to the conclusion that such abnormal rises lie approximately within a fixed range for the usual length of line and so constitute a smaller and smaller excess over normal voltage as the latter is placed at higher and higher values. It has been somewhat surprising to find from recent studies in this field that by means of switching, load changing and other types of disturbance the maximum values of transients do not as a usual thing exceed four or five times normal operating voltage.

Further data bearing on these important questions were presented before the international conference on high-tension networks held last fall in Paris, accounts of which appeared in the pages of the *Revue Générale de l'Electricité*. Oscillographic studies were made of overvoltages due to the resonance of harmonics in the generator wave, in the case of transient overvoltages of low frequency and also of high frequency, on a large 60,000-volt, 50-cycle system. Special measurements were made of the effective inductance and effective resistance, at frequencies between 300 and 1,000, of a transformer with connected cable, and also of a complete generating unit consisting of turbo-generator, transformer and three single-conductor cables, at various values of magnetic saturation. It was found that the inductances were largely those due to the leakage fields, other values not changing with either saturation or frequency. The effective resistances, however, were much greater than those for fundamental frequency. At 500 cycles the transformer resistance was seven times that of the alternator and transformer combined and fifteen times as great as that computed from short-circuit tests at normal frequency.

These figures mean that the factor of overvoltage for a harmonic in the neighborhood of 500 cycles is only 6.38, whereas if computed from resistances measured in the usual way this value would be 56 times as great! These figures were found to be in accord with oscillographic measurements on a three-phase generator connected to three step-up transformers and three-single conductor cables 8.8 km. long, all connected in star with grounded neutral. The experiments consisted in running with one high-tension phase short-circuited to neutral, the opening of this short circuit, and the taking of oscillograms of current and voltage in the short-circuited phase and of voltage on one of the other phases. The resulting oscillations were easily observed, and it was found that the overvoltage did not exceed one and seven-tenths times the normal value. Similar experiments were also made when putting into operation aërial lines and cables, and removing them, for both open and loaded conditions.

The results of these studies are very significant in their indication of the great importance of the presence of transformer and generator in reducing the values of

overvoltage resulting from any disturbance. This protective feature is to be attributed to the high values of effective resistances inherent in transformer and generator for the higher ranges of frequency involved in such disturbances. As a consequence of this conclusion it is further indicated that the only serious cause for trouble in such systems is in the opening of a long line which is carrying no load. Under these circumstances an arc is drawn which permits oscillation of the open line and which, since there is no generator or transformer connected, may thus cause serious overvoltage.

Philadelphia Points the Way

FOR the fourth successive time in as many years the Philadelphia Electric Company has announced to its patrons a voluntary reduction in rates. Of course, such reductions are predicated on wise and efficient management by which volume of business is increased and production cost lessened. Such a policy is bound to bring results and build up excellent public relations.

It is a wise company indeed that thus enlarges the number of its patrons and makes available to the community a cheap but excellent electric service. And what a wonderful testimony to the applicability and efficacy of regulation the incident is! In various quarters the efficiency and worth of public service commissions are at times questioned. Politicians in particular seek by innuendo to break down this bulwark of strength to the community and its public utility. The Philadelphia Electric Company, under the sagacious guidance of W. H. Johnson, proves how groundless such suspicions are and shows, moreover, that private initiative and enterprise are still potent factors in American business. When left to themselves, aided and abetted by sane and just regulation, the electric public utilities of the country can be relied upon to render a service unparalleled in cost and quality by governmentally owned utilities and equal to, if not better than, the best obtainable anywhere. The example of Philadelphia should be an inspiration to the rest of the industry.

Plans for Co-ordinated Appliance Advertising

WHOLE-HEARTED support of the program for the advertising of electric toasters during the coming month of March and coffee percolators in April should be given by all the interested branches of the industry. Behind it is the simple idea that if for a given period everybody advertises the same thing at the same time the aggregate impression on the American household will be far greater than can be accomplished by the scattered impulses of the ordinary individual advertising that is not co-ordinated. The idea arose at a meeting of the National Electric Light Association's Commercial Section last November, and it received the indorsement of the heating appliance section of the Associated Manufacturers of Electrical Supplies. The plan looks forward to setting aside similar periods for the intensive support of other household appliances next fall.

It must be understood that this is something entirely different from co-operative advertising, in which a group of manufacturers or others pool funds for the joint promotion of a commodity or service idea in which they are all interested. The present plan calls for simultaneous support of a prescribed appliance. All manufacturers, wholesalers or retailers of toasters, for instance, are invited and urged to devote their regular advertising to pushing the toaster in March and to give it any additional publicity that they can. Light and power companies will naturally join in.

The idea is admittedly but an experiment in joint advertising by the electrical industry. It is obviously not susceptible to general application the year round, because once all the months were dedicated to twelve selected appliances, the manufacturers of other devices would find themselves barred out of the industry's advertising calendar, which would be an actual restraint in trade. It cannot be expected, therefore, that the program will be extended very far. Nevertheless, the thirty-day drives on toasters and percolators will undoubtedly bring tangible benefits, and every one who is interested in these two devices should tie into the schedule, if only to prove the value of the idea. It is to be hoped that this experiment may ultimately lead to an organized group movement by the manufacturers of heating appliances that may have the full advantages of a continuous, progressive program of promotion.

This Matter of Rural Rates

RATES, it is generally agreed, are ticklish things. The rate schedule of the average central-station company represents as nice an adjustment of contrary forces as does that allegedly departed diplomatic ideal of balance of power in a group of egoistic nations. And chaos threatens when any change in the balance impends.

The opportunity to construct a rate which will stand four square and solid on its own merits is offered to every central station that contemplates the addition of rural load to its lines. The farmer who wants service shows by that desire that he is intelligent and progressive and is therefore capable of understanding the problem of getting service to him. There is no occasion for making rate concessions to get business; the rural field is almost entirely a seller's market, and the utility can charge the actual cost. One grants that costs for rural service must be higher than for urban service, but one cannot grant that these higher costs are any reason for regarding with trepidation the task of making the farmer see that they are legitimate or for ducking the responsibility by giving the farmer service the cost of which must be borne in part by other classes of consumers. There is no more reason to believe that the average American farmer wants to get what he does not pay for than that he wants to pay for what he does not get.

However, one may walk in the light of good intentions and still stumble or take the wrong path, particularly in a field which presents such diverse conditions as does rural service. In this issue are printed some executive opinions on this rural problem, together with an account of cost allocations and rate structures which appear to be working satisfactorily. Whether or not any one of those reported is the true shape of the amorphous ideal is a question that cannot yet be answered. At least each one is a sincere attempt to solve the problem and, as such, is entitled to study and consideration.

Mystic Lake Development in the Rocky Mountains

THE Montana Power Company has completed a 12,500-kva. power plant at Mystic Lake in a rugged and heretofore inaccessible section of eastern Montana. The lake has a storage capacity of 12,700 acre-ft. and is 6,545 ft. above sea level. The station operates under a head of 1,010 ft. and is connected by 55,000-volt transmission lines to the eastern part of the company's interconnected system.

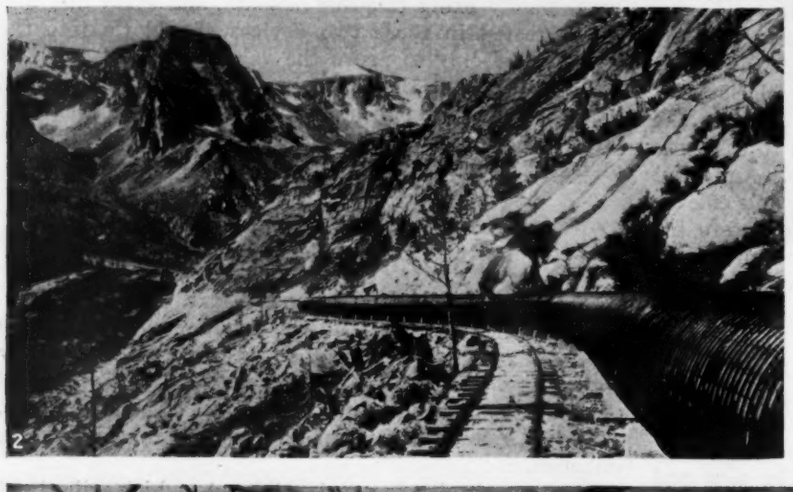
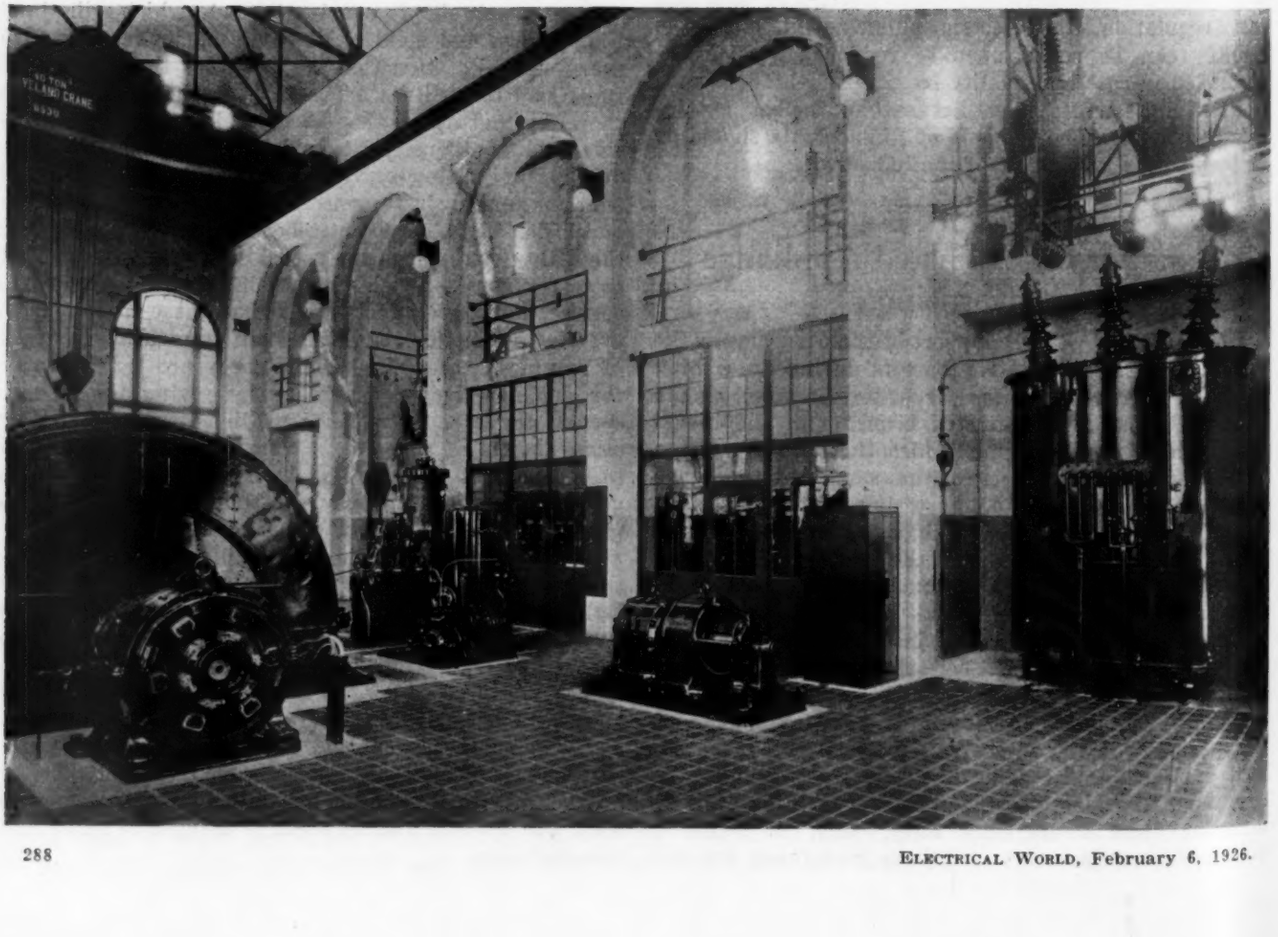


Fig. 1—Mystic Lake.

Fig. 2—Wooden-stave pipe 56 in. in diameter connecting the tunnel and the penstock.

Fig. 3—Interior of the power house.



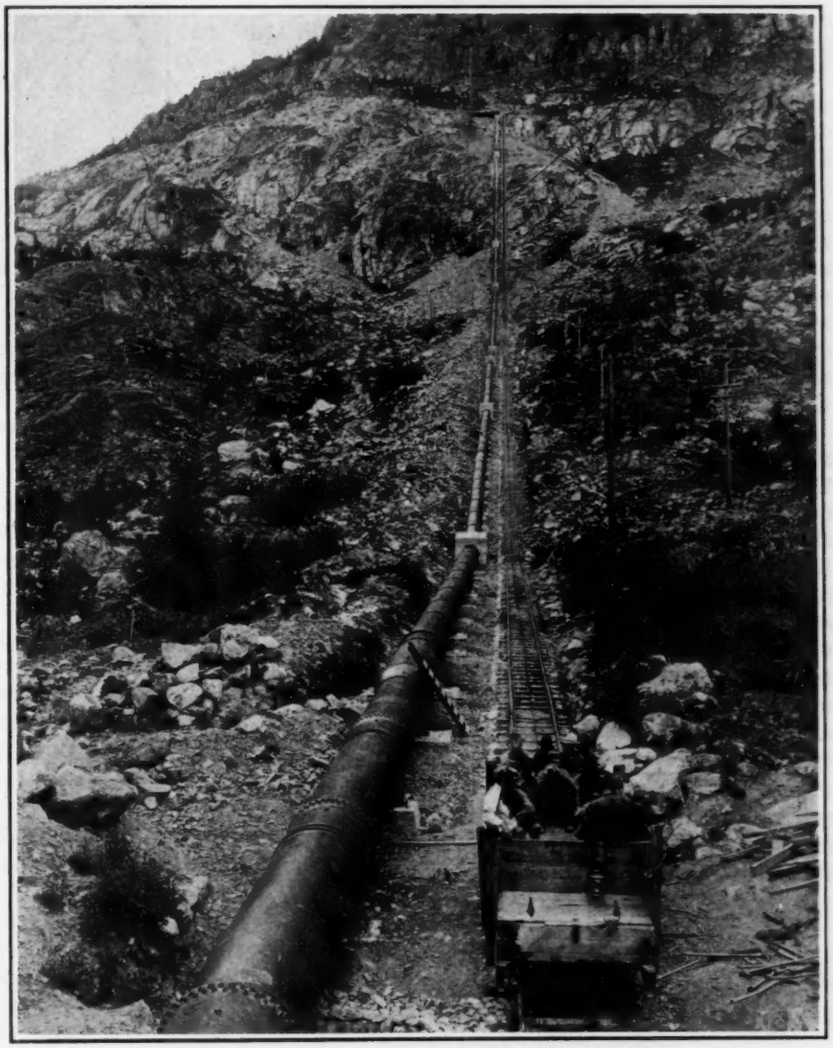
A Rocky Mountain Hydro-Electric Plant

Rugged Country Makes Construction of the Mystic Lake Development of the Montana Power Company Difficult—Tunnel Opening Into Lake Is Blasted Out

By M. E. BUCK
General Superintendent Montana Power Company

THE necessity for an additional power supply to its eastern Montana system led the Montana Power Company to undertake the development of the Mystic Lake site after consideration of several other possible hydro-electric projects. Work was begun in 1922 and a 12,500-kva. plant was completed and placed in operation in the spring of 1925.

Mystic Lake is located about 45 miles southwest of Columbus, Mont., its nearest railroad point. Before any construction work at the site could be started it was necessary to build fifteen miles of 5 per cent maximum grade highway, which required many months during the early stages of the development. This and the problem of transporting material to the diversion works at the outlet to the lake made construction work unusually slow and difficult.



PENSTOCK AND TRAM LINE, MYSTIC LAKE DEVELOPMENT

HYDRAULIC FEATURES

The average annual discharge of the drainage area above Mystic Lake is approximately 165 sec.-ft., varying from 40 sec.-ft. minimum in the coldest weather to a maximum of 900 sec.-ft. during June and July. The initial development makes use of a maximum flow of 150 sec.-ft., with an available storage of 12,700 acre-ft. It is later planned to construct a dam across the outlet to Mystic Lake and increase the storage to 20,500 acre-ft. by raising the elevation of the lake 20 ft.

Water is conveyed from the lake to the plant through a 6x7-ft. tunnel, 1,000 ft. long; 9,000 ft. of 56-in. wood stave pipe and thence through a single lap-welded steel penstock. The penstock is 48 in. in diameter at the top and reduces through three reductions to 40 in. about 100 ft. from the power house. At this point the penstock branches into two 28-in. steel pipes leading to the two hydraulic units in the plant. A 28-in. hydraulically operated gate valve has been provided ahead of the needle nozzles on each waterwheel. At the lower end of the wood stave pipe line there is a special tee connection, one end of which connects with a Johnson surge tank and the other to the penstock through a 48-in. butterfly valve. A plan and profile of the project are shown in an accompanying illustration.

The driving of the tunnel and the tapping of the lake 48 ft. below its surface was an interesting engineering adventure which has been attempted on only one other project in the world—this being carried out successfully in Italy by Italian engineers. The bore was advanced until the top of the tunnel was about 11 ft. below the lake bed, at which point it was decided to halt the work and blast out an opening into the lake. It was estimated that about 700 yd. of material would have to be moved by the shot and it was concluded that 6,500 lb. of 90 per cent dynamite would be required. Five 6-in. holes were drilled from the surface at the edge of the lake down to and nearly connecting with the tunnel. These were charged with powder in order to

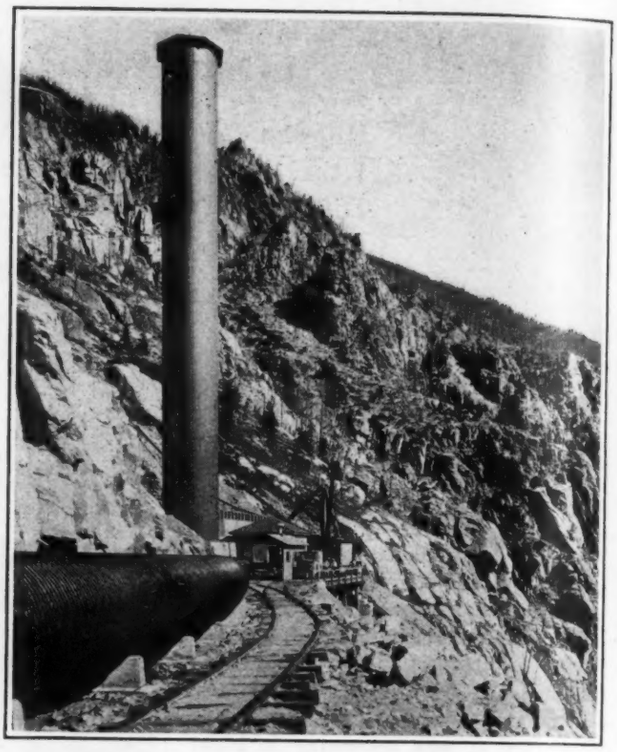
throw away the overburden that might be expected to slip down and close the opening, if one were successfully made by the shot at the end of the tunnel. Three systems were installed to insure the firing of the shot, one series electric system, one parallel electric system and one Cordeaux system. After careful consideration and preparation the great shot was fired, successfully accomplishing the desired result. The effect was spectacular and terrific. This shot with its attendant preparation cost approximately $50,000, but the company feels amply repaid for the money spent on an engineering gamble, because it advanced the completion of the project at least four months.

POWER HOUSE CONSTRUCTION, WATERWHEEL AND ELECTRICAL EQUIPMENT CAPACITIES

The power house is constructed entirely of reinforced concrete and is 88 ft. long, 60 ft. wide and 41 ft. high. Two 6,250-kva. Westinghouse generators are direct connected to two 7,500-hp. Pelton impulse waterwheels operating under an effective head of 1,010 ft. at 300 r.p.m. Each unit is provided with a 50-kw., 125-volt, direct-connected exciter and a spare motor-driven exciter of the same size, which are connected to a common bus. Normally each generator is supplied from its own exciter, but in case of emergency both generators may be supplied from any one of the three exciters in the plant.

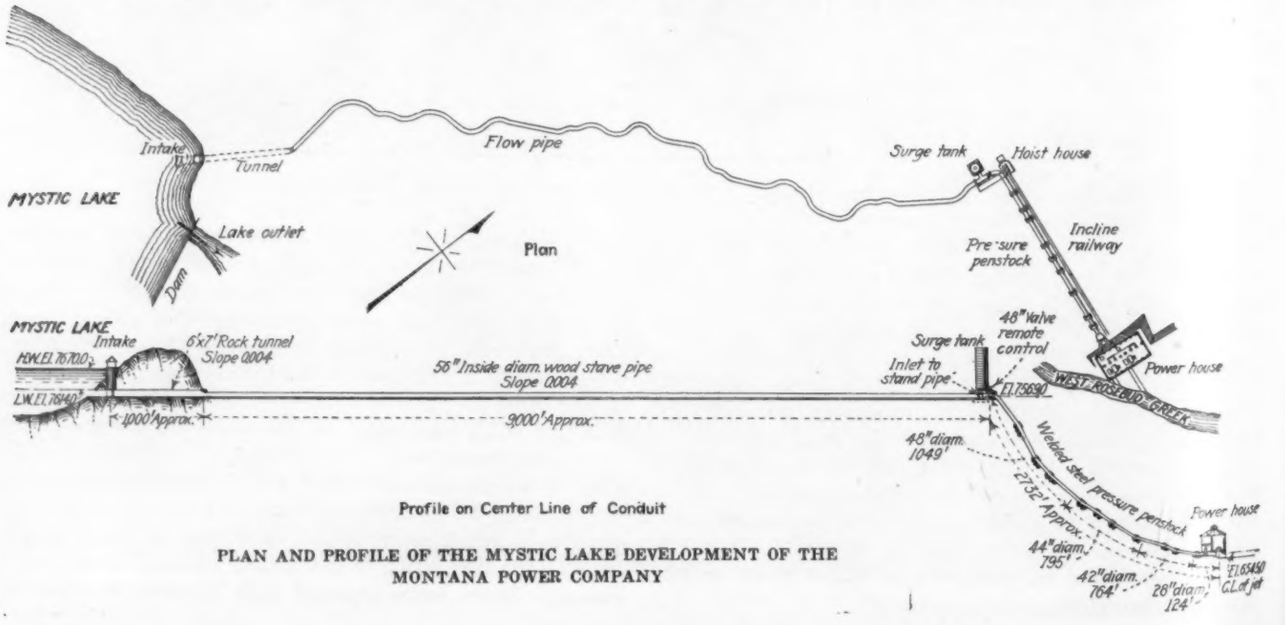
Each generator is tied to a single low-tension bus sectionalized by two sets of disconnecting switches. Two 6,000-kva., 6,600/55,000-volt, three-phase, 60-cycle transformers are tied to the low-tension bus through oil circuit breakers and disconnecting switches. Each transformer is tied solidly to a section of the high-tension bus through a set of disconnecting switches. The high-tension bus is divided by two sets of disconnecting switches into three sections, one each for the two transformers and one for a future transmission line. Oil circuit breakers on each of the outgoing transmission lines provide the necessary control over these circuits.

With this arrangement it is possible to operate each generator and transformer as a unit through to the outgoing lines, should this be desired. Lightning protection on the high-tension bus is provided by a single aluminum cell lightning arrester. Instead of bringing out the generator neutrals and installing current transformers, a set of power directional relays is installed to furnish the equivalent of differential relay protection.



JOHNSON SURGE TANK PROTECTING WOOD STAVE PIPE LINE AND PENSTOCK

The two three-phase transformers are mounted in bays on the first floor opposite the generators. The main switchboard is mounted between these bays and the whole arrangement is such that the plant may be operated by one man per shift. The high-tension bus, disconnecting switches and oil circuit breakers are mounted on a balcony above the transformers and switchboard. A 40-ton crane was installed to handle the heavy equipment during construction of the plant and is available for maintenance should it be needed.



Profile on Center Line of Conduit

PLAN AND PROFILE OF THE MYSTIC LAKE DEVELOPMENT OF THE MONTANA POWER COMPANY

Tentative Rural Service Policies

Some Utilities Going After Rural Service Business Where It Will Be Economical for Both Utility and Farmer, but Differ in Methods of Financing and Rate Structure

SHOULD electric-service utilities wait to serve farmers until the rural-service study now being made in more than fifteen states is completed? Of course, some companies started serving farmers years ago, but many of these farmers were served from existing lines, were close to cities, or were served without profit. Lately other utilities have come to believe they should start before any more time passes, but don't know the solution to many of the problems. Many companies contend that until experience from experimental lines in their territory progresses further and warrants building rural lines, these lines should not be started except possibly on a more extensive experimental scale. General construction of rural lines at this stage, they consider, would be a serious mistake for both power companies and farmers. Other companies feel that they have acquired sufficient information to justify constructing rural lines under certain conditions. These utilities have adopted tentative policies that will enable them to go after the business in such a way that it will be economical to serve either large or small rural consumers, if these customers are willing to accept the terms.

Policies differ somewhat. Some companies favor utility financing of lines to leave the farmer money to purchase utilization equipment. Others favor farmer financing or divided financing, but in every case with the line operated and maintained as utility property. A few utilities are applying a rate composed of a high fixed charge with low energy charges; others a plain step-rate energy charge. The difference is chiefly due to the attitude which different communities have toward these two forms. As stated in an editorial in the Sept. 19, 1925, issue of ELECTRICAL WORLD, there is general agreement that the chief thing to avoid in this day of extension of service is the possibility of farmers in adjacent districts paying totally different amounts for the same kind of service. A tendency is being shown toward putting rural service under a specialist, preferably a man who is well acquainted with farm problems. Different methods of helping the farmer finance the purchase of utilization equipment are employed or considered, such as paying farmers to build lines under utility supervision, arranging for deferred payments on equipment, relieving the farmer of financing lines, etc. All companies recognize the necessity of helping the farmer in the solution of his application problems.

No one can say what is the best method or if a single method can be used. However, some tentative practices will be related for the benefit of companies that are searching for the correct solution. In presenting this information attention must be called to the fact that no two lines are alike and that to make any comparable statement, fixed conditions must be established in order that all companies may be figuring on the same problem. Some companies are apt to make their estimates of cost on lines that have more customers per mile and per dollar invested than can be expected with a full development of the territory. In Alabama, they admit that the lines they are testing have far above the average number of customers per mile. In another case the plat of a line shows sixty-eight customers on 9½ miles of line, yet if the territory in which this line is located were developed to a more reasonable extent, there would be only about 2¾ customers per mile. Considerable information is needed for the interpretation of practices that will have a bearing on the costs of construction. The specifications of the line, whether in a rocky country with crooked roads, as in Pennsylvania, or in an easy-digging loam soil with straight roads, as in Iowa, and many other such data may influence costs considerably.

A WISCONSIN VIEWPOINT

G. C. Neff, vice-president of the Wisconsin Power & Light Company, Madison, Wis., and chairman of the N. E. L. A. rural-service committee, says:

"In rural districts, where rural electric service is justified from the viewpoint of both the farmer and the utility, where the farmers are willing to subscribe to the form of rate charged by our company, and where the average cost of the distribution line per customer does not exceed $400 each, our company will finance the entire cost of the distribution line, transformers and meters necessary to supply service to farmers in the district. The rate charged for such service consists of a monthly fixed service charge of $5.50 per month where a 1½-kva. transformer is installed per customer plus an energy charge of 5½ cents per kilowatt-hour for the first 30 kw.-hr. per month and 3½ cents per kilowatt-hour for all over 30 kw.-hr. per month.

"If the installation involves a 3-kva. transformer, the monthly service charge is increased to $6. If it requires a 5-kva. transformer, the monthly service charge is increased to $6.60. The energy charge is subject to a discount of ½ cent per kilowatt-hour if bills are paid before the last discount day.

"A figure of $400 per customer has been used as the maximum average. However, we feel that the actual average will be approximately $375 per customer, and it is for this reason that calculations are based on $375.

"At the present time we are connecting up a number of farmers who have agreed to pay these rates and they seem to be satisfied. In talking to the farmers regarding this plan we do not emphasize the service charge, because it is something which they do not understand readily. If the rate is applied to an energy consumption of about 200 kw.-hr. per month the monthly bill will be $12.50, or at the rate of a little over 6 cents per kilowatt-hour. We try to get the farmers to understand that to make the service profit-

able to them it is necessary for them to use about 200 kw.-hr. per month. Next we show them just what can be done with 200 kw.-hr. of energy and they are then asked whether or not it is worth $12.50 per month to have these things done.

"In the territory served by us there are approximately 40,000 farms, 2,700 of which are now receiving electric service. We believe we are very conservative when we say that at least 25 per cent of the total number of farms will have electric service within a period of five years.

"We have a specialist in charge of rural electric service who is an agricultural engineeer—a graduate of the Agricultural College of Wisconsin University. At the present time he is the only man in this department. However, he has authority to call on and receive help from a large number of employees scattered over our property. We shall build up this department just as fast as we find it necessary to do so.

"The chief duty of the rural-service department is to take charge of that part of our business in the same manner that the commercial manager takes charge of the commercial activities, the director of safety takes charge of accident prevention activities, etc. He is responsible for the rural electric-service activities of our company. All correspondence relating to that subject which comes to the general office is turned over to him. He keeps in close touch with the rural-service activities in other states and other countries. He assists the field men in properly explaining rural electric service to the farmers who are contemplating securing such service. He helps the field men apply electric service to agricultural conditions. He follows the new extensions for some time to collect information regarding how the service is being used and in general devotes his entire time in closely following the whole development."

Opinion from Iowa

Arthur Huntington, Iowa Railway & Light Company, Cedar Rapids, Iowa, says:

"There are in the territory served by the Iowa Railway & Light Company about 69,000 farms. No attempt will be made to get more than 200 rural consumers in 1926 and 1927, but during the succeeding four or five years the company will consider taking rural consumers on at the rate of about 500 to 750. This is plenty fast enough, we believe.

"This company has been devoting a large part of its time to the Garner farm line and has been working very closely with the farmers. Two or three men devote part of their time to soliciting rural trade, not with the view of taking on more farm customers but to sell the idea of rural electrification to the farmers. The chief duties of the rural department is to sell to the farmers not only the idea of rural electrification but the idea of analyzing rural costs. It is quite probable that a man will be placed at the head of the farm division who is a good engineer and who at the same time is thoroughly familiar with costs and rates.

"At a meeting of the Iowa Industrial and Agricultural Commission, of which the writer is a member, the farmer group asked for a copy of our fabricated cost data to see how they could be applied to farming costs. A transportation sub-committee of the Agricultural and Industrial Commission asked for the same data to see if they could not be applied to freight costs. In this locality there seems to be a general awakening to the fact that we must study costs, not as a whole but in their fabricated form, not only in setting up electrical rates but in all classes of business and manufacture.

"One of the strangest things to me is that utility men are not trying to get cost plus profit out of rural service, but rather are trying to justify themselves in making a low rate by denying the existence of some items of cost and failing to take into consideration the full value of costs that they know exist."

A Milwaukee Idea

F. A. Coffin, sales manager of the Milwaukee Electric Railway & Light Company, says:

"Our plan is not a tentative plan, inasmuch as it has been in operation for several years and we have furnished rural service to a large number of Wisconsin farms and built line extensions under our line extension plan sufficiently to feel that there is no question about the plan or the rate being tentative or uncertain. We have found the plan satisfactory, and it has met with no difficulties, so we are using it regularly and expect to continue using it.

"In our rate the service charge is based upon the number of rooms and buildings on the premises. The minimum service charge is $2 and includes four counted (active) rooms and a connected load of 3 hp. in motors. Each counted room after four raises the minimum 40 cents per month, but entitles the customer to five additional kilowatt-hours. Each horsepower or fraction thereof after three raises the minimum charge 50 cents per month. The average farm, excluding three bedrooms and miscellaneous unwired buildings, will not have more than six or seven counted rooms. With seven counted rooms and 3 hp. in motors, the minimum charge would be $3.20 per month, and this would include the use of 35 kw.-hr. Any energy in excess of this amount would be billed at the rate of 3½ cents per kilowatt-hour.

"This company invests in line and service connections an amount equal to three years' estimated revenue from the installation of a customer or a group of customers. Thus, if a mile of line costs $2,500 and serves eight customers whose minimum bills average $6 per month, the revenue from the eight customers would be $576 per year, or $1,728 for three years. This deducted from $2,500 would leave $772 which the eight customers would advance, or about $98 per customer. We feel that we can get farther by selling this proposition to a farmer than we could if we made the investment free of charge and billed the customer $8 or $9 per month. The customer will forget the $98 in time, but on the other basis he will never forget the regular monthly high bill.

"We have had two or three men working on rural and interurban service for several years, but only recently have we organized a specific rural service commercial division in our sales department. This division consists of four salesmen and is in charge of a man designated as rural service agent. He is an engineer with a number of years' experience in central-station work in both small and large industrial communities. He grew up on the farm and is thoroughly versed in farm mechanics. He does not happen to be a college-

trained man, but is a competent electrical engineer, a high-class salesman and a man of resourcefulness who understands the farmer's problems and his point of view.

"Our rural service department's chief duties are selling electric service to the farmers in the territory we serve; also selling equipment, appliances, etc. Our rural men will survey territories, propose line extensions, solicit electric service business along all existing lines, endeavor to sell equipment and appliances and demonstrate the uses of electricity on the farm both publicly and privately. They will conduct exhibits at fairs and other public gatherings where they seem to be warranted. We are just investigating the number of farms in the territory we serve now and making forecasts of development."

An Illinois Practice

J. F. McCarthy, commercial department Central Illinois Public Service Company, reports that his company has a specialist in charge of rural service who is not an agricultural engineer but who has spent a large portion of his ten years in the utility business with farmers. Besides this man, six others devote part time to rural service. There are about twenty-five thousand farmers in the territory served, 25 per cent of whom should be accessible in the next five years. The chief duties of the rural service department are to keep in touch with developments in rural service, aid in power applications, etc.

Mr. McCarthy goes on to say: "The company furnishes free the equivalent of a two-pole extension for each customer served; also the meter and transformer installations. The customer is asked to finance the rest of the construction necessary to serve him. The farmer may buy equipment through the company on a very liberal payment plan, and if enough equipment is bought to warrant him being placed on the heating or cooking rate, or both, he receives a refund in accordance with the heating and cooking schedule. The rates are $3 per month minimum for lighting, with an energy charge similar to the one that is in effect in the town from which service is rendered.

"In the past the only manner in which a rural customer could obtain any of the money which he deposited with us was in case other customers received service from the same line. Under this policy very few customers ever received any considerable amount of money from the company. In the future the company will return to each rural customer twice the amount of his annual bills for service rendered for power and cooking, but not for lighting. This money will be refunded at the end of the first twelve-month period after service has been rendered and received. Under no circumstances, of course, will we return an amount of money in excess of the amount deposited by the customer.

"This plan of repayment will work out as follows: Assume that one customer's share of an extension is $300. The company will allow the investment of a two-pole extension, or $50, making the amount of money the customer must deposit $250. If the customer installs an electric range and a motor and the total bills for the first twelve months for the range and motor are $100, the company will return to the customer at the end of the twelve months $200 and the customer will have an investment of only $50 in the line. This change in policy will be an incentive to install additional equipment."

Meter-Reader Salesmen Increase Business

Work of Salesmen and Meter Readers Combined—68 per Cent Business Increase Secured—Morale of Employees Strengthened and Good Will of Public Safeguarded

AN EXPERIMENT of unusual interest to new-business men of public utilities has been carried on for some months by the Waterloo division of the Central Iowa Power & Light Company, Waterloo, Iowa, and has produced such excellent results as to warrant the attention of utility executives who are interested in stimulating merchandise sales, increasing net profit and safeguarding friendly customer relations. Some months ago R. R. Frey, sales manager of the Waterloo division of the Central Iowa Power & Light Company, established an outside sales organization consisting of meter readers and regular appliance salesmen. The objectives in mind were: (1) To break down sales resistance by assuring the salesmen entrée to the home of the prospect; (2) to create and maintain friendly customer relations by reducing the number of company representatives calling on the customer, thereby reducing possible sources of irritation and grievance. That the plan has great possibilities may be judged from the number of favorable comments of the company's customers after the inauguration of the plan and by an increase in merchandise sales of 68 per cent for the first month of operation under the new plan, with proportional increases for succeeding months.

Meter-Reader Salesmen

At the time the new plan was put into effect three outside salesmen and four regular meter readers were serving 10,560 homes having 10,549 electric meters and 9,172 gas meters. The salesmen were making a house-to-house canvass, picking up prospects as they went along and making what sales they could, being supported by some newspaper advertising and by broadsides mailed out on one appliance each month. Salesmen were being paid a straight salary, but only one was selling anywhere near his quota. Meter readers were of the average type, getting in and out of the house as quickly as possible, giving the familiar call "meter reader" as they opened the door, hurried through and on to the next house. If there was any question about a bill or a complaint of service, the customer was simply, though politely, advised to "call the office."

These seven men were called together, had outlined to them the entire plan of combination duties and were thoroughly sold on the importance of the new work to themselves and to the company. The men were impressed with the fact that service is really all a utility has to sell and that a company is not really giving complete service unless it is making possible the acquisition and satisfactory use by the customer of those appliances that lighten labor and beautify the home. In building good will a company does not go far when the meter reader, frequently the only point of contact with the customer, runs into the house and out again. To serve the company and the customer effectively these combination men must be of good appearance, pleasant, courteous and possessed of sufficient knowledge to answer all questions a customer may ask

and must be able to adjust minor complaints on the premises. To do this work the men must have territories small enough to allow time for answering questions, making sales, servicing appliances and covering their meter routes. Dividing the customers among seven men gave each man approximately 1,500 homes, compared with 2,700 homes previously. The meter readers were attracted by the opportunity for more dignified and easier work and greater compensation. The salesmen quickly realized the possibilities of carefully planned campaigns, where entrée to the home of the prospect was practically guaranteed. This plan has very effectively eliminated the greatest obstacle to direct selling—namely, that of gaining admittance to the home.

PUTTING THE PLAN INTO EFFECT

The adoption of continuous reading of meters was necessary to the working of the plan, because best results may be obtained only when the men have a definite number of meters to read each day, leaving a definite amount of time for sales and service work. During the first two months the salesman and meter reader worked together, reading meters and explaining the plan to the customer. While one man was going to the attic or basement to read the meter, the other man was selling the idea to the customer. The salesman soon learned to read meters accurately, being checked up very carefully by the man in charge of this work. Salesmen in turn coached the meter readers on correct approach and sales talk to the customer and largely by example showed the value of good appearance.

At the end of the two months the salesmen had taken off all their surplus weight and were full of energy, and the meter readers were on their toes, were dressing better, looking like different men. All of these men are expected to be on the sales floor on Saturday night to meet customers of the company and, by actual selling, to learn the principal features of all the appliances. The moment a customer of one of these men enters the office, he is greeted in a pleasant voice and asked if he can be served in any way. Very often a customer after paying a bill is induced to look at some appliance or to select a carton of lamps.

Each man is paid $125 per month, $62.50 being charged to meter reading and $62.50 to merchandise sales. The merchandise department credits the men with 15 per cent commission on all sales, except on industrial appliances. This gives a monthly quota of $416 per man. The men are given credit for all major appliances sold to customers in their territory by the store sales force. Credit on small appliances and lamps is given only on sales made by the men themselves. The store sales force receives a salary and one-half of 1 per cent on all sales made by them. When it is necessary for one man to call on another for assistance on a sale, the commission is divided equally between the two.

The woman in charge of the company's home service follows up all complaints the day after they are made to see that everything is satisfactory. She also assists the salesmen on demonstrations and, after major appliances have been sold, visits the customer to make certain that the operation of the appliance is thoroughly understood. The salary of this woman is divided equally between promotion of new business and merchandise sales.

Believing that much sales effort and many sales helps are dissipated because salesmen lack the proper training and proper tools, Mr. Frey has provided each man with a sales manual explaining the duties of a public utility representative, the importance of selling the company and the service of an appliance rather than the mechanics and the construction of the appliance itself.

A loose-leaf catalog listing every appliance sold by the company is provided for each man, showing the cash price, deferred payment price, amount of down payment and monthly payment. A set of questions and answers has been prepared to help the men to meet successfully objections of the prospect. During each campaign a broadside is furnished with full description of the appliance and an explanation of the special offer. This broadside is not mailed, but is presented personally to each customer by the salesman as he goes to read the meter. The salesman gives a short sales talk when presenting the broadside, goes on to read the meter and returns to discuss the appliance further. If necessary, he arranges for a later call or an appointment for both the man and wife at the company's office. As the office is open on discount and Saturday nights, the salesmen have been quite successful in getting the man and wife to come in together.

WHY THE PLAN WORKS

As compared with the old-time salesman of the foot-in-door type who was hard to handle and upon whose goings and comings it was difficult to keep a check, the plan used in Waterloo makes possible accurate check of the location and activity of any salesman at any time. Adherence to meter routes makes possible frequent communication with the salesman at little inconvenience. Each man has his definite territory in which he may be considered in business for himself. He has the use of the store to show his merchandise to his prospect. He has adequate financial backing, complete credit facilities and his advertising and window displays are arranged for him without charge. The only limitation to the man's earning power is his capacity to sell the service of the company, through selling appliances to the clientèle he is enabled to build.

These men sell the idea that the company as a central station is not interested in the immediate profits from the sale of the appliance, but is interested in the continued use of the appliance in rendering uninterrupted and satisfactory service to the customer. With each call at a home these men are building good will not only for themselves but for the company, and their position with the customer should be a strong one whenever the company has any particular message to bring before its customers. On the question of franchise or change in rate, these men should be the best prepared to deliver the message to the company's customers.

POSSIBILITIES FOR OTHER COMMUNITIES

The training of combination meter readers and salesmen has possibilities for utilities operating in small towns as well as for those in cities. In many small communities the volume of merchandise sales will not support a full-time salesman, but the training of the man who now reads meters and does trouble shooting to sell and service appliances should enable the utility to develop appliance business, build up connected load and at the same time strengthen the good will of its customers.

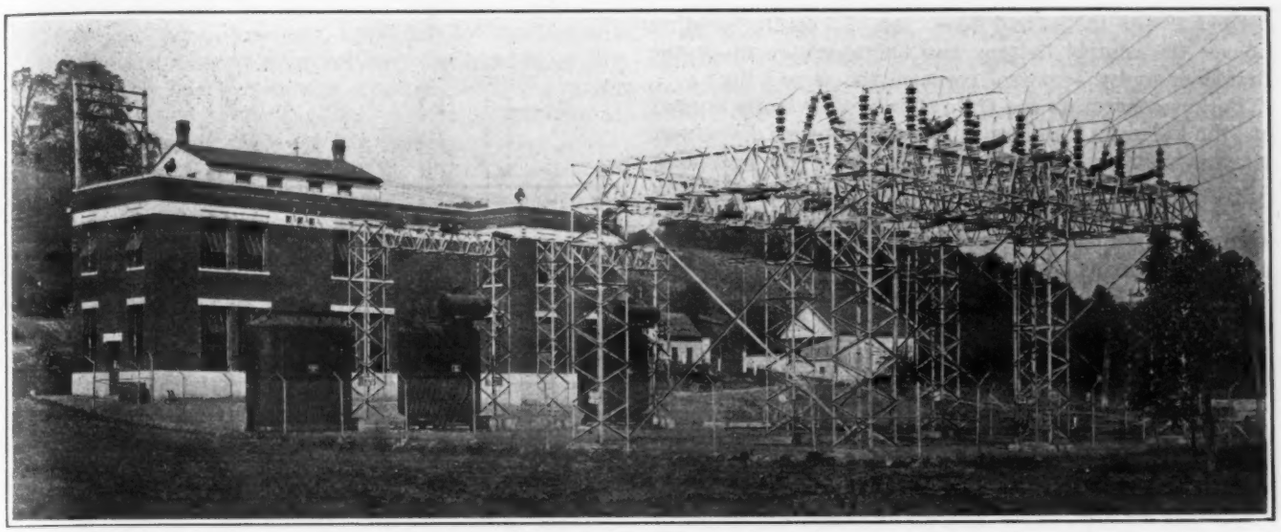


FIG. 1—EXTERIOR VIEW OF VIOLET HILL SUBSTATION

Substation Designed for Safety

Violet Hill Station of the Pennsylvania Water & Power Company Uses an Ingeniously Devised System of Switch Interlocks to Prevent Injury to Persons or Damage to Equipment

By N. B. HIGGINS
Assistant Chief Engineer Pennsylvania Water & Power Company

THE Pennsylvania Water & Power Company recently completed its Violet Hill substation, located on the outskirts of York, Pa. It is fed by two 70,000-volt, 60-cycle, three-phase transmission lines from the company's steam-hydro development at Holtwood, Pa., and supplies power at 13,200 volts to the Edison Light & Power Company of York. It was designed and built by Day & Zimmermann, Inc., and incorporates safety features, group operating, grounding and interlocking mechanisms developed especially for this installation by engineers of the Pennsylvania Water & Power Company and the Electric Power Equipment Corporation.

At present each transmission line and its transformer operate as a unit, although the outdoor steel work has been designed for the future installation of line oil switches, lightning arresters, tie bus and bus tie oil switch. The initial capacity of the station is 10,000 kva., 70,000/13,200 volts, and is designed for an ultimate capacity of 20,000 kva., 110,000/13,200 volts. There are three 5,000-kva., three-phase O.I.S.C. transformers of the conservative type. One of these is a spare and is not connected to the lines. All high-tension switching equipment and transformers are located outdoors; the low-tension switching and control board are housed in a brick building.

The high-tension switching equipment consists of a type RR. motor-operated load break air switch on each line. Each of these switches is combined with the hand-operated line ground switch. The ground switch and line switch are mechanically interlocked so that it is impossible to have both closed at the same time. Closing the line ground switch opens the motor circuit of the corresponding line switch, thus giving additional safety. Line switches are controlled from the switchboard and the line ground switches are always padlocked in either an open or a closed position.

In the main part of the building oil switches, potential and current transformers are on the first floor; bus disconnecting switches and station trans-

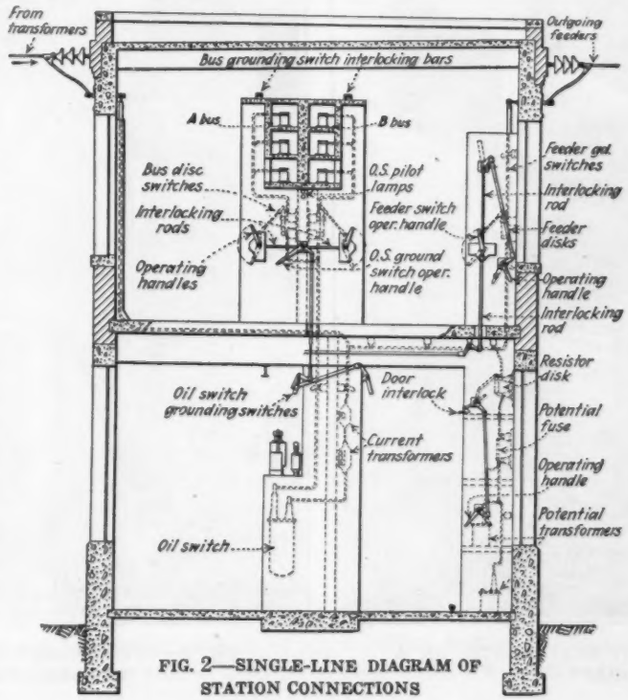


FIG. 2—SINGLE-LINE DIAGRAM OF STATION CONNECTIONS

former are on the second floor. An "L" on the building houses the control battery and operator's room on the first floor and the control room on the second floor.

Because operators are from time to time badly burned or even killed by standing in front of a loaded disconnect when it is pulled, all oil switches and their corresponding disconnects were grouped in pairs with a passageway between from which all operation is done, so that in the event of any mistake in switching the operator is clear of the resulting arc.

All circuits run across the building without cross-connections, thus minimizing the danger of the attendant becoming mixed up in a switching operation. The buses are totally inclosed in a concrete structure and arranged vertically on either side of a 6-in. wall. The oil switch bus disconnects are mounted vertically above the oil switches, to which they are connected. All potential transformers, except bus potentials, feeder disconnect switches and feeder ground switches, are mounted against a wall. Bus potential transformers are mounted at one end of the bus structure.

The safety rules of the company call for all apparatus to be grounded before any work is done on it. Experience has demonstrated the desirability of having all grounding apparatus group-operated and thoroughly interlocked with equipment to which it is connected in order to prevent it from being closed in on live circuits. Fig. 3 is a cross-section of the building and shows clearly all grounding apparatus and interlocks except those on the bus. Group-operated grounding mechanisms have been provided for the oil switches, outgoing feeders, buses and potential transformers. The oil switch grounds are interlocked mechanically by means of notched disks and sliding rods with the corresponding bus disconnects so that it is impossible to close the ground switches when either of the bus disconnects are closed, and, conversely, it is impossible to close the bus

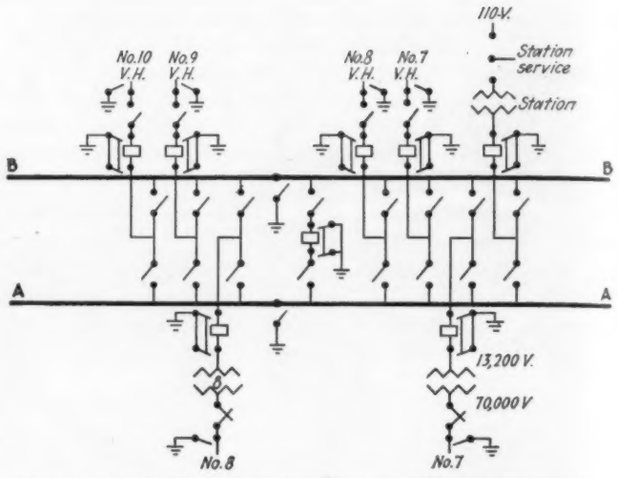


FIG. 3—CROSS-SECTION OF STATION, SHOWING GROUNDING APPARATUS AND INTERLOCKING DEVICES

disconnect while the ground switch is closed. When the oil switch is on an outgoing feeder, its ground switches are further interlocked mechanically by means of a plate and pipe with the feeder disconnect so that neither of them can be closed at the same time. The feeder disconnect is also interlocked with the feeder ground switch.

The oil switches are a dead tank type, so they are grounded by grounding with two ground switches the cables on both sides of them. This is done by utilizing the cable supports mounted just above the oil switch as the tongue of the grounding switch. A special clamp is used on this cable support, which clamps directly on the bare cable instead of on the insulation. The ground switch blades are keyed to a $1\frac{5}{16}$-in. operating shaft mounted above the switches. The blades are connected together by a heavy copper strap, which in turn is connected by flexible leads to the ground bus. These

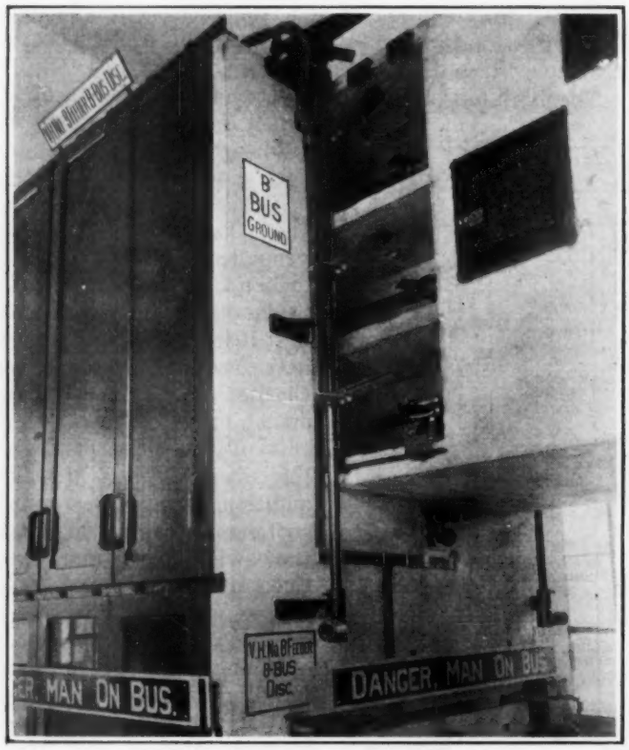


FIG. 4—BUS-GROUNDING SWITCHES MOUNTED ON A VERTICAL SHAFT

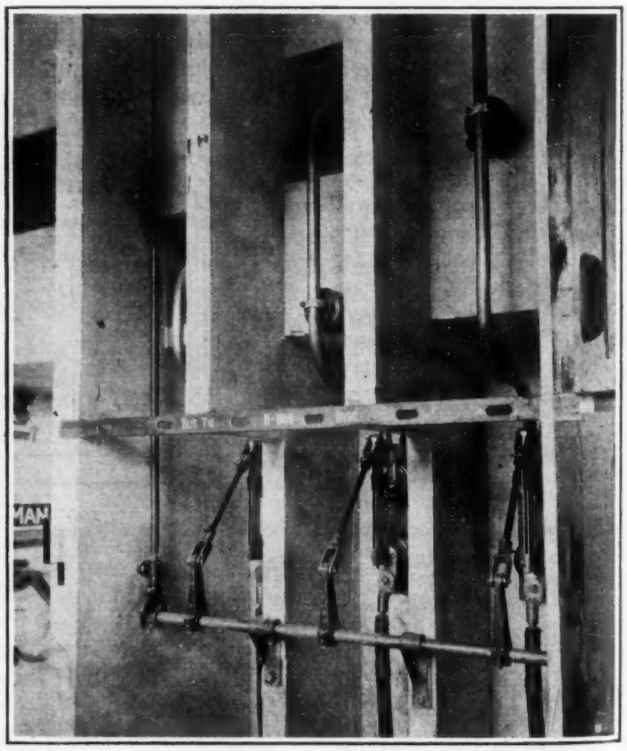


FIG. 5—BUS DISCONNECTORS INTERLOCKED WITH BUS-GROUNDING SWITCHES

switches are simultaneously operated by one handle mounted on the second floor between the handles of the corresponding bus disconnects with which they are interlocked, as shown in Fig. 3. A similar scheme is used for grounding the outgoing feeders.

The bus-grounding switches (Fig. 4) are mounted on a vertical shaft on one of the passageways near the center of the bus structure. The tongues for these switches are clamped in the bus, and the switch blades revolve horizontally. These bus-ground switch-operating shafts each operate a ½x2-in. strap (interlocking bar) which moves on roller bearings along the top of the bus structure and vertically above bus-disconnect switch-operating shafts. These latter shafts each carry a cam which operates a vertical rod, shown in Fig. 5, raising or lowering it whenever the bus disconnects are closed or opened. When the bus-ground switch is open, these vertical rods pass through a hole in the ½x2-in. locking bar mounted on top of the bus structure, but when the bus-ground switch is closed, they strike the locking bar and prevent the closing of the bus disconnector. Thus it is impossible to close a bus-ground switch when a bus disconnector on that bus is closed and vice versa.

All potential transformers are equipped with current-limiting disconnecting type resistors and fuses. These resistors are group operated and interlocked with the safety doors on the potential compartments so that it is impossible to open a door while the resistors are closed.

All disconnects and ground switches are of the truss blade type. All disconnecting switches, although they are group operated, are equipped with latching type safety locks so that the operating mechanism is not called upon to hold the switches closed under any conditions of service or short circuits. Exhaustive tests made by the company on disconnect switches had proved the effectiveness of the type of lock installed, and it, rather than the operating mechanism, is relied upon to hold the switches closed.

Boxes on the bus-disconnect operating handles house interlocking disks and cam-operated switches, the latter controlling standard telephone type ruby and emerald pilot lamps in the dummy bus on the switchboard, which enable the operator to read from the board the position of all disconnects. Provision has also been made in these boxes for locking the handles with Yale locks in either an open or closed position.

Experiments on Cable Insulation

Laboratory Tests on Insulating Compounds Used in High-Tension Paper-Insulated Cables Show Effect of Temperature in Forming Voids —Methods Devised to Neutralize Temperature Changes

By E. G. GILSON
Research Laboratory, General Electric Company

THE desirability of transmitting power underground at higher voltages, in order to increase the capacity of the present duct systems as well as to decrease the losses, has created a very definite demand for a better cable insulation to withstand these high voltages.

Many tests on cables showed conclusively that the results obtained could not be predicted from the history of the sample during preparation—that is, there was a factor not under control, influencing results. All the samples tested were made under laboratory conditions with rigid control over all such factors as conductor paper, compound, drying and impregnating, etc.

Along with the other things investigated in the search for this unknown factor was the insulating compound. The first thing to attract attention in this was the fact that the normal cycle of temperature in the cable from no load to full load took the compound from the solid to the liquid state. It was also easily shown that the thermal expansion from 25 deg. C. to 150 deg. C. was about 6.5 per cent. To note the effect of this expansion, a glass tube, approximately 1 in. in diameter by 36 in. long, was filled with a standard cable-insulating compound. This was done by pouring in the compound after heating above the flow point.

Each end of the tube was closed by a cork stopper. A rod, extending the length of the tube and projecting through each stopper, held them in place by means of a nut on the outside of each. Care was taken that the tube was completely full, without visible voids at room temperature.

A section about 8 in. long in the middle of this tube was then held in an atmosphere of steam for about forty-five seconds. As the steam was not under pressure, this corresponded to a temperature of about 100 deg. C.

Behavior of Heated Compound

This time and temperature were sufficient to liquefy the petrolatum in short sections in the middle of the tube, but left the ends solid. The expansion due to this slight heating was sufficient to force the compound out around the stoppers at each end of the tube. Upon cooling, the resultant contraction drew the compound away from the stopper at each end, probably sucking in air; but it also caused a bubble about the size of a large pea to form in the middle of the tube. "Piping" might have formed in the compound, but it could not be observed.

A tube of about the same size but sealed at each end and having a side branch about 6 in. long near one end was next filled with the compound by means of vacuum. Both tube and compound were evacuated and the tube sealed, after filling, by means of a rubber stopper tied in with wire. Heating this tube over the steam bath, beginning at the end farthest from the side-branch and working toward it, forced the stopper completely out. Repeating the experiment, but heating only about 8 in.

on the end this time, forced the stopper partly out, but upon cooling it came back. Also many bubbles formed on the end that had been heated.

This experiment was then repeated, using a longer tube (about 6 ft.), and heating about 12 in. on the end. Only heat enough was used to melt the compound in for about ¼ in. from the surface. In cooling back to room temperature small bubbles appeared in about one hour and on standing overnight a large cavity about ¾ x 2¼ in. appeared about 9 in. from the end that had been heated. As the room temperature went up this cavity disappeared. This was probably a change of temperature of 4 or 5 deg.

By allowing this tube to lie in the sun for a while and then holding it under tap water, complete separation of the petrolatum could be obtained. This would be as much as ¼ in. wide and extended completely across the tube. The maximum range of temperature causing this, as indicated by thermometer in the sun and under the tap water, was 15 deg. C. The tube was left neither in sun nor under the tap water long enough to come to temperature equilibrium with either.

Tests on Standard Cable

A piece of standard 2/0 $\frac{32}{32}$-in. paper test cable was then put into a glass tube similar to the one described. The piece of cable was about 36 in. long and was placed in one end of the tube, which was about twice that length. The glass selected was as close a fit to the cable as could be handled. This was evacuated, dried and impregnated according to standard cable practice. The whole thing was then installed in a wooden box having a heater lamp and cooling coil so that temperature control could be maintained. With a temperature of 33 deg. C. the tube was full of petrolatum, with no voids of any kind to be seen. Upon cooling to 26 deg. C. a large cavity (about ¾ in. to 1 in. wide by 4 in. long) appeared between the cable and glass, and extending from it lengthwise of the tube a crack about 8 in. long and ⅛ in. wide.

All these voids in the glass tubes would disappear completely on raising the temperature sufficiently and reappear on lowering it. They would not, however, reappear in the same place nor in the same form with any consistency, but might reappear anywhere and in any shape.

Realizing that there is a big difference between the coefficient of expansion of glass and lead, and that the above-mentioned results are therefore misleading, a piece of lead pipe sealed at one end was filled with petrolatum (by evacuation). When cold the top was cut off smooth. Simply holding this in the hand for a few minutes would cause the petrolatum to extrude from the open end. Any difference, then, between a glass-covered and a lead-covered cable must be one of degree only.

On the basis of the generally accepted theory that cable failures are caused by corona and that bubbles or voids are conducive to the starting of corona, these experiments would seem to show that the thing to do was to use a compound sufficiently liquid to flow readily at all temperatures to which the cable might be subjected and thus prevent the formation of voids. The futility of hoping to do this with a solid compound can readily be seen from these experiments, for supposing the cable to be full at any given temperature, a slight rise above that temperature would exert pressure enough to stretch the lead, which would take permanent set and not come back when the temperature came back. But the compound would come back and thus voids would be formed. Or if, on the other hand, the temperature drops below the given temperature at which the cable is full, voids must necessarily form.

Liquid Filler Used to Prevent Voids

It thus looks as if the condition to be met is one of changing volumes due to the different physical characteristics of the materials used. The most logical way of meeting this condition is by means of a liquid filler, as stated above, and by providing means to circulate this filler readily. Applying these principles to the design of some cable samples, a very decided improvement was obtained. It was now found possible to make samples that would give consistent results on tests. Failures could be traced back to a definite cause or results could be duplicated with a fair degree of accuracy. It was found possible to operate at a much higher voltage stress on the insulation with absolute safety, and it was possible to work out a definite factor of safety between the short-time breakdown voltage and the safe operating voltage. The short-time breakdown voltage averages about 15 per cent higher than the solid petrolatum-filled cable and maximum and minimum vary only a few per cent from the average.

Samples having 2/0 B. & S. stranded conductor with paper insulation $\frac{32}{32}$ in. thick were tested for periods up to 1,000 hours at 91½ kv. without a sign of deterioration. Samples similar to these had a short-time breakdown of about 138 kv. and a power factor of approximately 0.5 per cent practically flat up to 100 kv.

This is an operating voltage of 325 volts per mil (average) of insulation thickness and a short-time breakdown of 491 volts per mil. No "free growths" appeared in any of these samples.

Flood Prevention and Generation of Electricity in Russia

IN A RECENT issue of the Russian electric journal *Electritchestvo* Prof. V. E. Lakhnitsky deals with the question of protecting the city of Leningrad against sea floods. As the result of a rise of water up to 13 ft. above the mean sea level which occurred at the month of the Neva in September, 1924, much attention is now being given to the problem of protecting the city and its suburbs against sea floods, and a special inter-departmental commission was appointed some time ago to study different proposals. The commission has examined three schemes, one of them planning high sea dams in the entrance from the Gulf of Finland into the Neva near the island of Kotlin, the second suggesting a nearer location of dams in the middle section of the bay, and the third favoring the erection of dams further up the Neva along the shore line of the bay and the seaside line of the isles in the estuary.

The second and third schemes embody a factor which is considered to be inevitable, the erection of a dam on the rapids of the Neva, 18 miles up from Leningrad. This dam is designed to retain the river discharge during the period of sea floods, from ten to twenty hours, in order to avoid accumulation of river water in the Neva mouth, when closed from the sea in time of floods. This dam would be utilized in connection with a hydro-electric plant working at a head of about 13 ft. and supplying up to 60,000 hp.

Selection of Tubular Bus Material

Mechanical Characteristics Essential to Selection—Tables Showing Deflections, Carrying Capacities and Other Characteristics of Tubular Buses—Test Results Made Available

By J. V. WALL
Winthrop, Mass.

HAVING selected a bus material of the proper conductivity, the correct design of outdoor bus arrangements necessitates a study of the mechanical characteristics of the conductor material to be used, inasmuch as too great a deflection in any portion of a horizontal member will produce an unsightly appearance. Likewise, any appreciable sag in a bus member will result in a low drip point being formed, from which heavy rains, melting snow or ice may cause a flashover should the low spot be in a location where normal safe clearance might be cut down by a series of drops of dirty water.

It may be stated generally that a properly designed bus should be perfectly straight in order wholly to satisfy the above requirements. However, the economic design of the steel structure that would be required to support a given bus in a sufficient number of points to make such an ideal design possible, together with the excessive number of insulator supports involved thereby, usually necessitates some divergence from ideal conditions. Obviously, no criterion can be stated here for the exact amount of deflection that should be classified as being good practice in all cases. This is entirely a matter to be determined in the design of each individual installation. It appears reasonable, however, to state that a satisfactory job will always be obtained if the amount of deflection in all horizontal members of a tubular bus is less than, or, in extreme cases, equal to, the diameter of the bus tubing. This criterion should always be applied to the condition of maximum deflection that occurs in a span having non-rigid supports at each end.

TABLE I—COMPARISON OF STANDARD I.P.S. AND EXTRA-HEAVY COPPER TUBING

	Moment of Inertia, I	Wt. per Ft., Wo	Multiplying Factor
1½-in. I.P.S.	0.2u1	2.689	.....
1½-in. extra heavy	0.244	3.460	.....
Ratio	1.216	1.286	1.058
4-in. I.P.S.	7.564	12.940	.....
4-in. extra heavy	9.615	17.270	.....
Ratio	1.271	1.334	1.049

The accompanying data will serve as an accurate guide to the results that may be expected for a number of the tubular materials commonly in use on outdoor high-tension structures. In Fig. 1 are shown the exact deflections in inches that will result from supporting the stated materials at distances shown, the insulator clamp supports being considered as non-rigid.

These curves were calculated with a view to covering all span conditions, including those arising in the design of 220-kv. bus structures made of tubular material supported on pillar type insulators, for which conditions unusually long distances between supports are encountered. The long spans occur in the taps from bus to oil switch terminals rather than between successive supports along a given bus, and it is probable that the scope of the curves in Fig. 1 will satisfy the most extreme case.

For the purpose of carrying out further calculations on special designs the procedure used in computing the deflections that were plotted in Fig. 1 may be followed by first computing the moment of inertia for any given size of tubing. Representing the outside diameter and inside diameter by D and d respectively, the moment of inertia is

$$I = 0.0491\ (D^4 - d^4)$$

Then, substituting this value, together with the modulus of elasticity and supported weight of the chosen material in the deflection formula for a uniformly loaded beam supported at both ends, the deflection for any number of distances between supports can be readily determined. Representing the supported weight by W, the distance between supports in inches by L and the modulus of elasticity by E, the deflection in inches is

$$D = 5WL^3 \div 384EI$$

It should be noted that this formula and the resulting curves in Fig. 1 apply only to the tap connections from a bus that may not have rigid supports at each end. For individual spans in a continuous bus or tap connection with several insulator supports, all spans except the two at each end of the bus or tap take the form of a beam with rigid supports at each end and will have a deflection equal to one-fifth the values given in the curves of Fig. 1. For a bus consisting of two spans of equal length with non-rigid clamp supports at each end two-fifths of the curve values of Fig. 1 should be used.

A very close estimate of the deflection of tubular materials other than those plotted in Fig. 1 can be made by correctly applying the relative moments of inertia, moduli of elasticity and unit weights in a proportion so that a factor may be arrived at, which, multiplied by the values given in the curves, will result in the deflection for any chosen tubular material under the same conditions of loading. Following this method of reasoning, one of the most common errors in outdoor bus design can easily be analyzed and the correct solution put into use by anyone concerned with designing or constructing outdoor bus installations. This error consists of using extra-heavy iron-pipe-size copper tubing in place of standard iron-pipe-size copper tubing, for the supposed reason that it will stand up better because of its greater cross-section. The truth of the matter is that the deflection of the extra-heavy tubing will always be somewhat greater than that of the standard pipe-size tubing. An inspection of Table I, which covers the only two variables for a given material and

span that affect deflection, shows this conclusion to be correct for two widely different tube sizes. Finally, the only two courses that remain to improve deflection conditions encountered in any given standard size of tubing material are: (1) To use a larger diameter size of tubing or (2) to use a tubing of approximately the same outside diameter but having less wall thickness; in other words, to use what is commonly called "O.D." or outside diameter tubing of a higher stubs gage number than that of the standard tubing.

Another interesting comparison can be quickly made in choosing between materials of the same size by a brief study of the variables that affect deflection for any given span. A comparison of the relative specific weights and relative moduli of elasticity (Table II) will show approximately what results will obtain.

These data show that copper is 1.126 times as heavy as steel and that its modulus of elasticity is 0.534 times that of steel. The deflection for the same size of the two materials at any given span will therefore be 110 per cent greater for the copper than for the steel tubing. It should be noted that this illustration is an approximate demonstration only and that its application would assume that copper and steel tubing have the same internal and external diameters. Reference to Table V shows a slight difference between the two in the smaller sizes, and the exact relative deflections can best be obtained from the curves of Fig. 1.

TABLE II—COMPARISON OF THREE TUBING MATERIALS

Material	Weight, Lb. per Cu.In.	Relative Weights	Modulus of Elasticity	Relative Moduli
Copper	0.3195	1.000	15,000,000	1.000
Steel	0.2834	0.888	28,000,000	1.870
Aluminum	0.0955	0.299	11,000,000	0.734

TABLE III—TEST RESULTS ON CONDUCTANCE OF STEEL PIPE

Size	Amp. for 30° C. Rise*	Sectional Area, Sq.In.	Current Density, Amp. per Sq.In.	Resistance Ohms per Ft.	Surface Area, Sq.Ft. per Ft. Length
¾ in.	120	0.333	360	0.000186	0.275
1 in.	190	0.494	385	0.000125	0.344
1¼ in.	225	0.669	338	0.000092	0.434

Electric Journal Question Box, Query No. 1711.

Table V gives the physical characteristics of the two materials that lend themselves most satisfactorily for use as outdoor bus conductors. In selecting the most desirable size of tubing to use for any given installation, the continuous current-carrying capacity in amperes may be conservatively estimated by multiplying the cross-sectional area of the copper tubing by 1,000 or of the steel pipe by 300. This value of current density in steel pipe is, of course, extremely difficult to calculate with any reasonable degree of accuracy. Test results on three small sizes of standard steel pipe are given in Table III, together with the physical dimensions and resistance of these three sizes. From the values of current density obtained by these results it appears reasonable to consider a density of 300 amp. per square inch as being conservative. Using this value of current density in steel pipe, the resulting temperature rise will be less than 30 deg. C.

For the convenience of engineers who may have occasion to choose between copper and steel pipe for high-tension bus construction the carrying capacities of all the common sizes of these two materials are listed in Table IV, allowance being made for two different current densities for each material to meet the requirements of the most conservative designs. In choosing between the two densities for steel pipe, it should be remembered that the resistance of iron or steel pipe varies from five to seven times the resistance of copper pipe and that the effective 60-cycle alternating-current resistance of test samples of steel tubing has been found to run as high as seven times the resistance to direct current. However, the generous radiating surface offered by a tubular section results in rapid dissipation of the heat energy due to resistance and iron losses in the bus conductors. It is also rapidly becoming an accepted practice to break up long continuous lengths of bus runs into a number of short groups separated by air-break switches for the combined purposes of flexibility in switching and isolation of high-tension equipment in adjacent bays. Hence the problem of thermal expansion in the iron or steel pipe does not assume a controlling influence in the design of modern 220-kv. bus layouts.

TABLE IV—CARRYING CAPACITIES (AMPERES) OF TUBULAR BUSES

Pipe Size	Copper Tubing 750 Amp. per Sq.In.	Copper Tubing 1,000 Amp. per Sq.In.	Standard Iron Pipe 200 Amp. per Sq.In.	Standard Iron Pipe 300 Amp. per Sq.In.
1 in.	353	470	99	148
1¼ in.	521	694	133	200
1½ in.	618	824	160	240
2 in.	815	1,087	215	322
2½ in.	1,197	1,597	341	511
3 in.	1,671	2,228	445	668
3½ in.	2,010	2,680	536	804
4 in.	2,380	3,174	635	952
No. 14 gage*				
2 in. O.D.	375	500	...	...
2½ in. O.D.	473	630	...	...
3 in. O.D.	570	760	...	...
3½ in. O.D.	668	891	...	...
4 in. O.D.	766	1,022	...	...

*For O.D. copper tubing of any other wall thickness, X, multiply these values by ratio $X \div 0.083$.

Having determined the required metal cross-section of a bus for a given service, the selection of the proper tubing size is then a matter of choosing, from Fig. 1, a tubing having the least deflection for the distance between insulator supports, which is in most cases determined by the nature of the bus structure. Due consideration should be given to atmospheric conditions in the vicinity of the proposed installation, as outlined later in connection with corrosion of steel in certain localities.

As an illustration of the proper selection of a bus tubing for a given installation, it was found, in deciding on the design of the delta bus for two banks of three 20,000-kva. transformers each, stepping down from

TABLE V—PHYSICAL CHARACTERISTICS OF TUBULAR BUS MATERIALS

Material and Size	Inside Dia., In.	Outside Dia., In.	Moment of Inertia	Weight, Lb. per Ft.	Conductor Area, Sq.In
Copper tubing I.P.S.*					
1 in.	1.062	1.315	0.084	0.823	0.470
1¼ in.	1.368	1.660	0.201	2.689	0.694
1½ in.	1.610	1.900	0.310	3.120	0.824
2 in.	2.062	2.375	0.674	4.224	1.087
2½ in.	2.500	2.875	1.436	6.130	1.597
3 in.	3.062	3.500	3.052	8.750	2.228
3½ in.	3.500	4.000	5.199	11.410	2.680
4 in.	4.000	4.500	7.564	12.940	3.174
Copper tubing No. 14 gage					
2 in. O.D.	1.834	2.00	0.230	1.94	0.500
2½ in. O.D.	2.334	2.50	0.461	2.45	0.630
3 in. O.D.	2.834	3.00	0.809	2.95	0.760
3½ in. O.D.	3.334	3.50	1.298	3.46	0.891
4 in. O.D.	3.834	4.00	1.960	3.97	1.022
Welded steel pipe					
2 in.	2.067	2.375	0.667	3.652	1.075
2½ in.	2.469	2.875	1.530	5.793	1.704
3 in.	3.068	3.500	3.018	7.575	2.228
3½ in.	3.548	4.000	4.789	9.109	2.680
4 in.	4.026	4.500	7.234	10.790	3.174

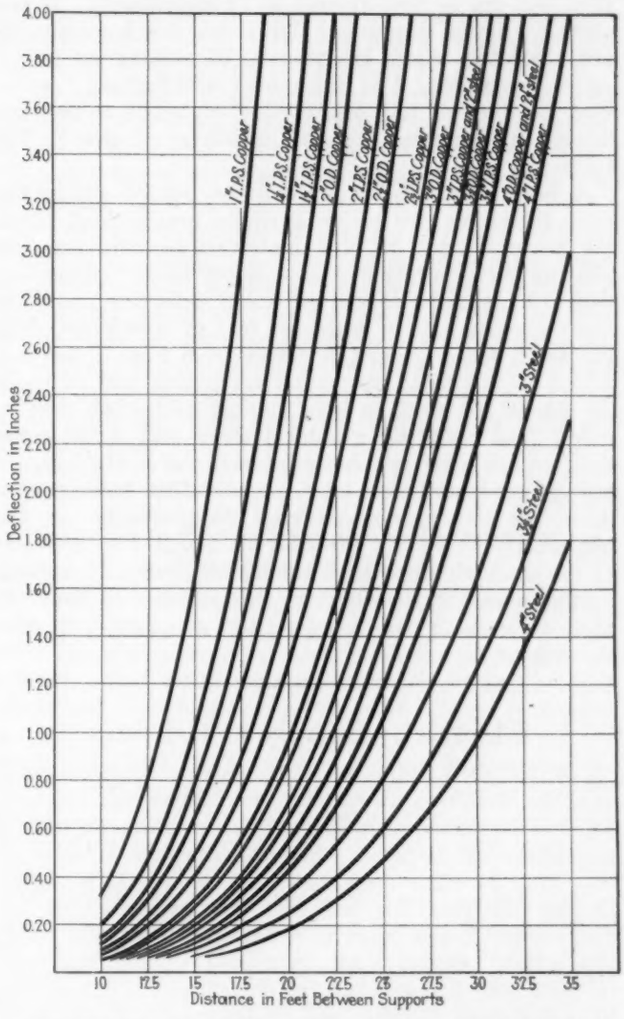
*I.P.S. tubing data based on dimensions of American Tube Works.

220 kv. star to 60 kv. delta, that 2-in. O. D. tubing of No. 14 gage was the most desirable material to use for the delta bus.

The current to be carried in the delta connection is approximately 580 amp., which requires 0.580 sq.in. of copper cross-section. From Table IV it is evident that 1¼-in. standard I. P. S. copper tubing would meet the current-carrying requirements of this installation. This standard stock material was consequently used for the vertical members of the delta connection, which could be conveniently strained at both the top and bottom of each member. However, this size of copper tubing was found to be unsatisfactory for the horizontal members of the bus, which served to complete the delta connection, since these could be supported only on 18-ft. centers due to the large size of the transformers and the resulting nature of the steel bus structure. Investigation of the curves (Fig. 1) shows a deflection of 2.10 in. for 1¼-in. I. P. S. tubing at a span of 18 ft., whereas the 2-in. O. D. tubing has a deflection of only 1.32 in. for the same distance between supports. The 2.10-in. deflection is far beyond the satisfactory limit set in paragraph 2 and the 1.32-in. deflection is well within this limit for a span having non-rigid supports. It was therefore decided to use the No. 14 gage 2-in. O. D. copper tubing, but practical considerations led to the use of 2-in. I. D. tubing, since no 2-in. O. D. tubing could be obtained at the station under discussion in time to meet the construction schedule. There is no appreciable difference in the deflections of the inside diameter and outside diameter tubing. It may be added that there is scarcely any noticeable sag in the existing installation as viewed from the ground, and it should be explained here that none of the actual spans in this particular installation took the form of spans having non-rigid supports at each end. Most of the spans took the form of having rigid supports due to the continuity of the tubing, but the extreme end supports of the outside spans were non-rigid in nature. This does not in any way disagree with the criterion established in paragraph 2, which is general in nature but indicative of all possible span and support conditions. The 2-in. O. D. tubing with a sectional area of 0.500 sq.in. was considered to have ample conductivity since the stipulated density of 1,000 amp. per square inch is very conservative for this kind of bus installation and may be increased to 1,500 amp. per square inch without overheating copper tubing.

Reference has been made in a previous paragraph to the fact that atmospheric conditions in certain localities would make the use of steel pipe undesirable, because of the destructive action that is set up by the presence of acid gases, which have been known to corrode steel structures to a serious extent. Consequently, in such sections of the country, the use of steel pipe would be out of the question, since the corrosive action of the acid fumes in the air would weaken joints between buses and taps, which must be strong both mechanically and electrically in order to stand up in service. It was for this reason that calculations were carried out on the copper tubing to the extent shown in Fig. 1. It appears that a copper tubing of 4-in. outside diameter would make a satisfactory bus material for superpower installations of 280,000-kw. or 300,000-kw. capacity, since the deflection for the maximum probable 35-ft. span is very nearly 4 in. for this size and material. A reasonable choice should be made that would eliminate the excessive weight and hence cost of the standard I. P. S. tubing and that would also eliminate the structural objections inherent in No. 14 gage 4-in. tubing. This latter material would be very difficult to handle without becoming dented, but a thicker tubing of, say, No. 8 gage with a wall thickness of 0.165 in. and weight of 8.38 lb. per foot appears very satisfactory should such long spans be encountered. The stock sizes on O. D. tubing usually include the even gages from No. 8 to No. 14.

For the majority of 220-kv. installations where the supported pipe bus can be suitably applied, it appears from the foregoing discussion that 4-in. standard steel



DEFLECTIONS OF COMMONLY USED TUBULAR BUS MATERIALS WITH NON-RIGID INSULATOR CLAMP SUPPORTS

pipe would also make a satisfactory bus material provided exceptionally long spans are involved in the design. Reference to Fig. 1 shows this material to have the least deflection of any of the materials shown. Also, a comparison of the 4-in. steel with 1¼-in. steel, for which latter the current-carrying capacity is known (Table III), shows that the 4-in. steel has 4.74 times the conductor sectional area of the 1¼-in. I. P. S. tubing (Table V). It also has 2.72 times the heat radiating surface of the 1¼-in. steel pipe. Using the density of 300 amp. per square inch mentioned above, the 4-in. pipe should safely carry better than 950 amp., which represents the current flow for approximately 380,000 kva. at 220 kv. three phase. The foregoing extreme examples are carried out merely for the purpose of

explanation and should not be considered as definite recommendations for any given design. It is naturally a question of weighing the all-important factors of cost, weight, deflection, current-carrying capacity and installation charges, which must be calculated and given proper consideration in the design of any specific installation.

The deflections given in the curves are also an index to the amount of initial set that must be put into a given horizontal bus member in order to make it stand up perfectly level. The amount of initial set cannot, however, be exactly determined from the deflection, but can be best arrived at by experiment. It has also been found in practice that unless the bus supports are absolutely rigid, the process of putting an initial set in bus tubing does not render satisfactory results, since settling of the long conductors tends to produce torsion in the members and cantilever strains in the supports.

A very interesting study may be worked out in the form of curves plotted on a single graph sheet using the various sizes of pipe materials as abscissæ and plotting these in terms of pounds per foot of conductor. One ordinate scale should represent deflection in inches and the other cost in cents per foot of conductor. The values of deflection can be taken from Fig. 1, the cost values at 21¼ cents per pound for copper and 4¾ cents per pound for steel, or local market values can best be used. The resulting graphical story will throw some light on the most suitable conductor material to use on any given installation, due consideration having been given to the current-carrying requirements of the bus material. It will probably be found that the cost of the stock sizes of O. D. tubing mentioned in a paragraph appearing elsewhere in this article will have the same base price per pound as the standard iron pipe size tubing.

Electricity Supply in Belgium

ACCORDING to the report for the last financial year, the Société d'Electricité de l'Quest de Belgique of Brussels is now supplying 74 localities with a total population of 194,992, while negotiations relative to supplying 24 other communal districts are in progress. During the year 168 miles of new transmission and distribution mains were laid, bringing the total up to 708 miles. Other work completed during the year included the construction of 50,000-volt transmission lines between Renaix and Audenarde and between Swevelghem, Vive and St. Bavon. The company is now supplying 14,627 kw. for power purposes and 4,884 kw. for lighting, the combined total showing an increase of 3,000 kw. during the twelve months.

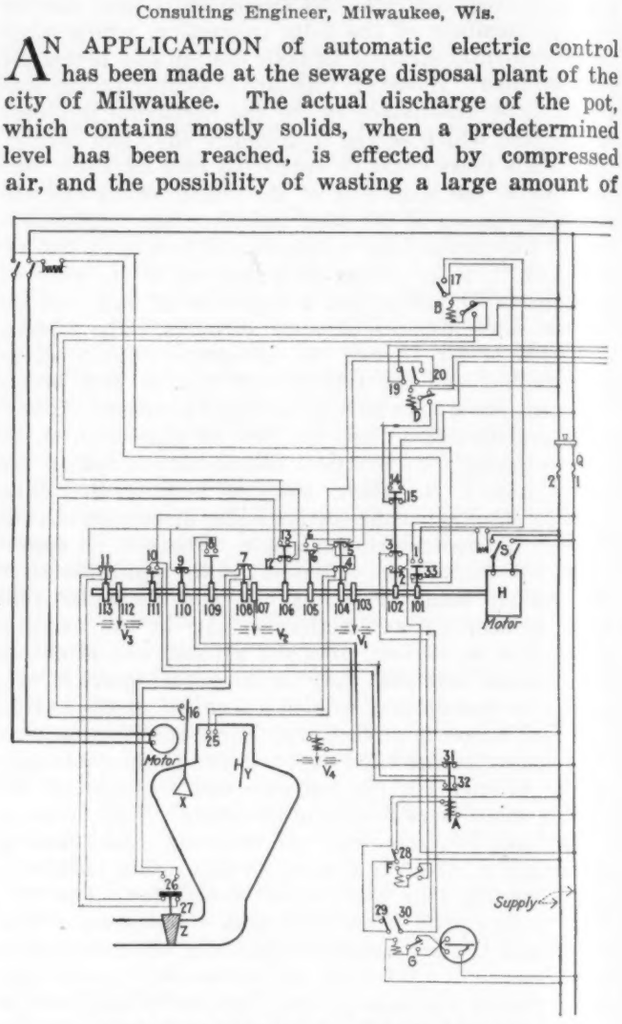
Notwithstanding the completion of its eighth power station at Bressoux-les-Liège, bringing the total capacity up to 142,200 kw., the directors of the Société Intercommunale Belge d'Electricité, in their report for the year ended June 30, state that, in view of the ever-increasing demand for electricity, they are arranging for a further extension of the production capacity to 180,000 kw. Thus a new 8,200-kva. turbo-generator set is being installed at the Paturages power station, one of 15,500 kva. capacity is being erected at the Malines station, while a fourth set of 11,500 kva. has been ordered for the Alost station, and also a fourth set for the Bressoux station.

Electric Control for Sewage Disposal System

Milwaukee Plant Uses Automatic Control to Insure Proper Timing of Dumping of Sewage Pots and to Save Labor

BY WILL J. SANDO
Consulting Engineer, Milwaukee, Wis.

AN APPLICATION of automatic electric control has been made at the sewage disposal plant of the city of Milwaukee. The actual discharge of the pot, which contains mostly solids, when a predetermined level has been reached, is effected by compressed air, and the possibility of wasting a large amount of



AUTOMATIC CONTROL FOR SEWAGE DISPOSAL

When the level of the material in the pot reaches that of the "level sensitive device" shown at *X*, contact 16 is closed, door *Y* is closed and the valve *Z* is opened. Contactor *V*-4 operates to admit compressed air to the pot, causing discharge. When the pot has been emptied, the air pressure is shut off, valve *V* is closed, door *Y* is opened for refilling and all contactors are reset for repetition of the cycle.

air if the operations are not properly taken care of is the chief danger to be guarded against.

The automatic control equipment, furnished by the Sundh Electric Company, Inc., is so arranged that the complete discharge of the screening pot occurs in the proper sequence and upon completion of the process of discharging and resetting the apparatus returns to its original setting and is ready for immediate repetition of the cycle. The control for the two screening pots is so interlocked as to make it impossible for both pots to discharge at the same time. Should both pots become filled at the same instant, the door, *Y*, of each pot will be closed, the interlocking master will then give preference to one or the other of the pots, which pot will

be completely discharged, and as soon as it is completely discharged and the door opened for refilling the second pot will continue through its cycle of being discharged. It is necessary to close the door as soon as the screenings reach the discharge level, because otherwise the screenings would pile up so high in the screening pot that the door could not be closed.

The use of electric automatic control equipment has effected a saving of one man's time on each watch and has brought with it certain intangible advantages generally connected with the electrification of control apparatus. The fundamental operating unit of the equipment is a motor-driven camshaft which provides the proper timing of the interrelated contactors, motors and valves.

Letters from Our Readers

More About Trees

To the Editor of the ELECTRICAL WORLD:

I am a lover of trees and entirely in sympathy with the sentiments expressed in recent references to them by ELECTRICAL WORLD correspondents, yet I believe we should not allow sentiment to outweigh other considerations in the attainment of the greatest good to the greatest number, lest we find that our solicitude has to some extent been misdirected.

The extension of electric service to rural districts is and will be for years to come a prominent issue, and yet the important bearing on this extension of present and future tree conditions has been sidestepped by many engineers. Observation of existing tree conditions along country roads shows that "volunteer" and haphazard planting of fruit and shade trees has created conditions which judicious removal or trimming can improve. It is worthy of note that many discerning property owners have voluntarily removed misplaced trees and obstructive branches, realizing that changing ideas and conditions of life should receive due consideration. Some of the causes of the tree conditions that have been encountered may be enumerated as follows:

1. Former traffic with horse-drawn vehicles did not require wide roads. The tendency today is everywhere for wider and wider thoroughfares.

2. Planters of trees along country roads, wishing to so place the trees that no appreciable land will be taken up and plowing remain unobstructed, have encroached in many instances on the necessary ditching for drainage, which when properly carried out exposes roots of the trees.

3. Large trees when untrimmed may become a hazard to passenger and vehicular traffic because of fallen branches, low branches and obstruction of light. Road-lighting units should be mounted high enough to be effective without glare.

4. The roots of certain types of trees, particularly willows, have a way of penetrating and destroying drains, walls and other subsurface structures. Several cases have been noted of houses which are damp and dark because of excessive foliage from trees planted so close as to shut out sunlight.

5. Inadequate trimming is a frequent source of radio interference.

6. The use of tree wire or high poles for passing certain portions of a rural extension contains pitfalls for the unwary engineer, for if one prospective customer is so favored, others, who have granted trimming rights, feel themselves slighted, and when the next rural extension is made the customers are prepared to demand high poles. The narrow margin allowed for this business will be wiped out once these situations arise. Some of the new customers, indeed, are dissatisfied at the start.

7. A few simple rules in regard to trimming have helped our company in tree work. They are:

(a) Every tree-trimming crew should have a foreman trained to do this work in a creditable manner in accordance with the principles of forestry. It is sometimes desirable to do the work under supervision or suggestion of the property owner.

(b) All brush should be removed and promptly disposed of. Often the property owner can hardly detect the parts trimmed if the brush is taken away promptly.

(c) All parts cut should be painted with suitable waterproof paint of dark color.

I have noticed no case of permanent injury to trees by proper trimming. Recent descriptions of cable installations in rural districts using a plow able to cut all ordinary roots are interesting. The area covered by the roots of ordinary shade trees roughly approximates the area covered by the branches, and any operation on the roots should be accompanied by the removal of an equivalent amount of the branches to facilitate complete recovery.

S. C. HENTON.
Akron, Ohio.

Advantages of a Liberal Policy in Servicing Household Appliances

To the Editor of the ELECTRICAL WORLD:

Servicing of electrical appliances is receiving considerable attention from central-station companies at present, and it seems to be difficult to reach any general agreement as to practice in this field. There is a tendency for customers to expect and take for granted too much free servicing in the home, which is costly to the central station in time and labor and sometimes in material. The situation is different where customers bring their appliances to the company's office and take them away "on their own."

We believe that in the latter case central-station companies should do something toward compensating the customer for his trouble, and we have found it advisable to make many repairs at little or no cost, charging for time and material where these amount to any substantial figure. Under these conditions we have just about managed to "break even." We are now trying the experiment of not making a charge for such repairs as broken connections in flatiron cords, etc. A not-distant company charges 40 cents for repairing a broken flatiron cord, even where no new material is required; but to us this seems a questionable practice. We believe that the extra cost of these nominal repairs should be charged against advertising and that the money involved is well spent. This policy tends to bring more people into our electric appliance store and in this way is created a decidedly better feeling toward the company.

The modern central-station company should never get away from the broad idea of service to the public in every sense of the word.

F. H. SMITH,
Vice-President and General Manager.
Worcester Electric Light Company,
Worcester, Mass.

Central Station and Industrial Practice

Construction Details of Tower Footings

BY H. A. PEARCE
Engineer Ohio Public Service Company, Sandusky, Ohio

THE reinforced concrete tower footings of the Ohio Public Service Company's 132,000-volt Sandusky Bay crossing were built on the rock floor of the bay at a depth of from 15.8 ft. to 35.5 ft. below the water level. All construction work was carried on from barges moored to fender piling around each of the six tower piers. The plan and section of the footing show the details of the bottom of the bay and the way in which each reinforced concrete cylinder was sunk 1 ft. into the rock. Each cylinder was tied to the rock by twelve 1¼-in. rods extending 8 ft. into the rock and 16 ft. into the cylinders. The cylinders are reinforced by twelve vertical rods and are laced together at the top with 24-in. I-beams supported on 12-in. grillage beams. Diagonal lacing consisted of 18-in. I-beams. All steel was field riveted and incased in concrete reinforced with ¾-in. longitudinal rods held in place with ⅜-in. round stirrups.

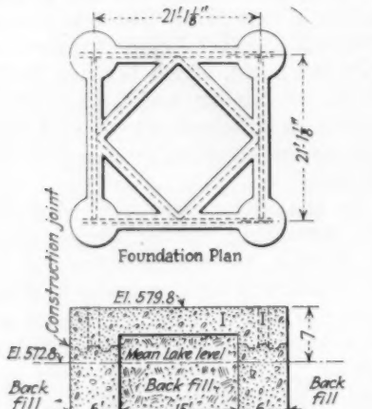


FIG. 1—PLAN AND CROSS-SECTION OF THE FOUNDATION FOR CROSSING TOWERS

Fig. 2 is from a typical construction log sheet and shows the way in which the concrete piers were erected. The inner and outer rings of sheet piling were used as concrete forms up to the construction joint, which was built into the cylinders

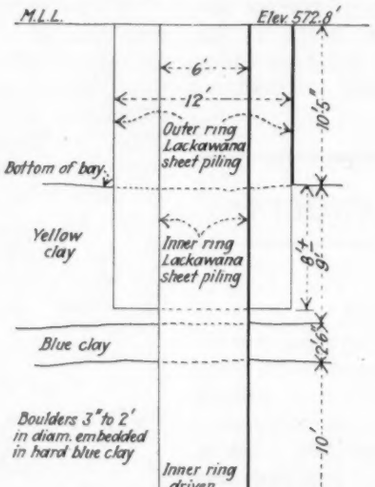


FIG. 2—METHOD OF COFFERDAM CONSTRUCTION USED IN POURING CONCRETE

4½ ft. below the finished elevation to allow for the setting of anchor bolts and steel frame tops. The space between the inner and the outer rings from the bottom of the bay to about 3 ft. above mean lake level was filled with well-tamped blue clay. This was done before construction started and made the excavation practically dry. All designs were made under the direction of G. W. Saathoff, chief construction engineer of Henry L. Doherty & Company.

Inventory Form Used by Hydro Commission

TO AID in keeping accurate, careful accounts the Hydro-Electric Power Commission of Ontario has adapted a standard form for transmission line inventory. This form is kept in the records and enables the commission at any time to find the total capital expended on any transmission line and the equipment in use on that line.

Among other data listed is the total operating capital expended on the line up to date. This amount is divided into items of right-of-way, supports, insulators, conductors and auxiliaries, with a total from which is obtained the total capital per mile invested and the operating capital per mile. The form also contains a section devoted to line data, which includes length, right-of-way, number of circuits, supports, insulators, conductors, auxiliaries and communication systems. The item of supports is divided into several subheads such as tower or pole heights, standard spans, crossarms, pins and ground cables. All of this information is kept up to date and any construction or maintenance that is carried out on the line is promptly recorded so that the record is at all times current. Space is provided on the back of the form for recording any data in connection with other properties involved or with line crossings that would be of help in case of trouble from these causes on the line.

Testing Circuit-Closing Induction Relays

BY J. R. HALLADAY
Meter Department, Ohio Public Service Company, Cleveland, Ohio

THE relay test set developed by the Ohio Public Service Company described in an article in last week's issue may be used to test circuit-closing induction relays with connections made as shown in the explanatory diagram which accompanied that article. After the load is adjusted by closing the necessary switches the "bypass" switch is opened and the "cycle counter operating" and "trip" switches are closed. From this point the set is automatic in operation. When the push switch is momentarily closed, the overload relay closes its contact and the relay begins its operation simultaneously with the cycle counter. The instant the tested relay closes its contacts the overload relay opens the circuit, removing the load and stopping the cycle counter. Sufficient current flows in the relay trip circuit to operate the auxiliary switch in the relay and also the operation indicator.

Successive tests may be made by simply closing the switch circuit without the operator having to

change his position, as is usually necessary to throw switches or readjust load. The test may also be started by pressing a button releasing the overload relay shown at the right of the ammeter.

No errors are introduced by chattering of the relay contacts or rebound of the disk when excessive currents are applied, and the test results may be relied upon to be correct. Timing as low as one-tenth of a second may be made successfully.

Self-Contained Synchronous Motor Buhrmills

Vertical, Direct-Connected Units Save Space, Power and Maintenance — Great Aid to Safety in Corn and Feed-Grinding Plants

SYNCHRONOUS motor-driven buhrmill units installed in the plant of the A. E. Staley Manufacturing Company, Decatur, Ill., appear to offer a solution to the old problem of driving corn and meal grinders using stones or buhrs mounted on vertical shafts. No previous methods of driving buhrstones have ever been entirely satisfactory, according to the statement of G. E. Chamberlain, general superintendent, on account of the necessary lowness of the drive. The solution of the problem in this large plant was found in the use of specially constructed, self-contained, synchronous motor units with the buhrstones mounted on the upper end of the motor shaft.

Saving in Space, Increase in Production

The new units, Mr. Chamberlain states, are to his knowledge the only positively constant speed buhrmills available. Side pull has been eliminated, and a thrust bearing carries the entire load of motor and stones. This self-contained unit occupies only one-sixth of the floor space required by a belted machine.

A most important condition for efficient grinding is constant speed. A variation in speed changes not only the volume but the quality of the feed produced. It is only when the stones are operating at constant speed that the mill can be properly adjusted, dressed and regulated. The constant speed of the synchronous motor gives a uniform production of high quality.

Maintenance Reduced

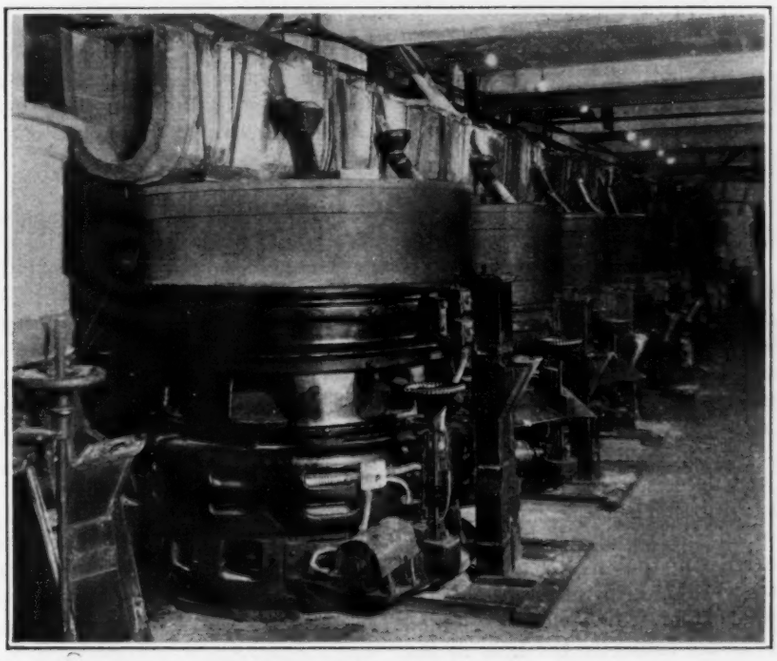
The old type of mill used in the Decatur plant was a constant source of trouble because of the maintenance of the neck and step bearings. The generous use of ball and roller bearings in the new mill has reduced the maintenance to a nominal amount. In operating a long line of buhrmills a failure of the supply of material may result disastrously to the stones if they are not immediately separated. On the new units the pressing of a button starts a motor-driven mechanism on every machine and automatically raises every stone in the line.

Each mill, being self-contained, is handled as a separate unit. Instead of dismantling the mill in place when the stones become dull, the motor leads are disconnected and the entire machine is picked up by an overhead crane and transferred to the stone-dressing department and a new unit is immediately lifted into place. This entire operation may be accomplished in less than ten minutes and means that the mill line is always full; there is no dead space in the rank. The old and cumbersome method of adjusting the distance between stones by a hand wheel and threaded arm is replaced by a motor-driven device, controlled by two push buttons.

Tests conducted by Mr. Chamberlain gave the results shown in the accompanying table.

In a similar mill of equal size and speed but belted from a motor, grinding 200 bu. per hour, the load on the motor was 93 hp. The saving of one-third of the power compared with the old mills is second in importance only to the greater safety and lower maintenance of the new equipment. The surplus capacity of the motor is used profitably in raising the power factor of the entire plant load.

Five electric buhrmills are in operation at this plant, each mill of 125 hp., 225 r.p.m., and supplied at 440 volts. The motors are provided with automatic starters. The complete units — motor, frame, stone mountings and control — were furnished by the Electric Machinery Manufacturing Company, Minneapolis.



BUHRMILLS, DRIVEN BY 125-HP., 225-R.P.M., 440-VOLT, SYNCHRONOUS MOTORS, IN PLANT OF A. E. STALEY MANUFACTURING COMPANY, DECATUR, ILL.

ENERGY REQUIREMENTS

Output of Mill, Bu. per Hour	Average Load on Motor, Hp.
100	48.2
150	54.9
200	63.0

Observations on 120-Kv. Line Performance

INCREASING interest is being shown in the compilation of experience which, when analyzed, will indicate the cause of operating trouble and enable the prevention of its recurrence. Information has just been made available as the result of an investigation of the performance of the 120-kv. line of the Detroit-Edison Company skirting the city of Detroit. This line now includes 165 miles of 120,000-volt steel pole and tower line, parts of which have been in service two years and all of which has been in operation at least one year.

According to A. A. Meyer, assistant general superintendent of the Detroit Edison Company, little trouble was experienced on the 120-kv. lines during 1924. Of six cases of trouble reported during that year, four were due to lightning; the fifth was caused by a crane flying into one of the lines, and the sixth occurred when the bottom wire of the line dropped to the ground at one point due to a mechanical defect in the insulator hardware.

Considerable lightning was experienced during the summer of 1925, which was very productive of trouble, including considerable insulator damage. Klydonograph records indicate that many high-voltage disturbances occurred on the lines during that period. Eighty-three cases were listed during the year representing trouble actually found on the field. All of these cases did not necessarily involve line trip-outs. Furthermore, some trip-outs occurred for which no trouble was reported in the field. Altogether there were 171 switch trip-outs in 1925, most of which were explained by evidence found on the line, in the station equipment or by general disturbances on the system.

Of the 83 cases of line trouble reported in the field, 66 represent damage done by storms, thirteen involved chipped or damaged insulators, apparently caused by shot or stone, and four include lines that were damaged by foreign objects. Of the first group, 42 cases showed signs of flashover. Analysis of these by line indicated that one line in particular (Bloomfield to Superior) was hit most frequently by storms, more than 42 per cent of the insulator string damage due to lightning occurring on this line. For this reason a ground wire has been ordered to be installed on this section as an experiment.

A high percentage of the total insulator string damage was reported for the Brownstown-Navarre line (more than 26 per cent), owing evidently to the fact that a thorough daily patrol was started on this particular line that disclosed damage not brought to attention by operating conditions.

Considering the individual insulator strings, the most serious damage was observed on units next to the wire and the next most prevalent damage on the top unit next to the tower, more than 24 per cent of the insulator damage being found in the first position and more than 30 per cent in the top position. From this information Mr. Meyer concludes that the present arcing horns at the lower end of the insulator strings are not quite satisfactory, and that it would be well not only to provide better arcing horns or rings at the lower end but also to provide a suitable horn at the upper end of the string.

Regarding the phase wire which was involved in the trouble, analysis of the data shows that more than 64 per cent were associated with the top wire and 25 per cent with the bottom wire. The middle wire, being protected on both sides, apparently suffers the least.

Very little data are available regarding the effect of flux control compared with the standard-string insulators and arcing horns on parallel sections, as only one case of trouble had occurred on each line since Sept. 6 up to the date of the analysis of the information. On the section of line equipped with flux control a cascade flashover occurred involving all units in one string with

Transmission Line Standards

AMONG the standards that have been adopted for actual practice by the Utica (N. Y.) Gas & Electric Company are those governing the construction of transmission lines. These standards are given in the accompanying tables and show the recommended insulation, wire spacing for bare copper wire, clearances and span lengths. These standards are of considerable value when designing transmission lines and also in their actual construction, as they can be very easily followed by the men on the job.

CLEARANCE FOR TELEPHONE LINE

Insulate telephone line for one-third line voltage when wood arms and pins are used for telephone insulators and insulate for one-half line voltage when grounded metal supports are used for telephone insulators. Transpositions are recommended every 500 ft. to 600 ft. in telephone lines. Insulating transformers and lightning arresters are essential and drainage coils are recommended.

Line Voltage	To Ground, Ft.	To Conductors, Ft.
13,200	16	4.5
22,000	16	5
44,000	16	6
66,000	16	8

RECOMMENDED MINIMUM CLEARANCE TO GROUND

This is at lowest point in span over country or along roads, but not over roads or railroads. At 60 deg. F. and no wind.

Voltage	Clearance to Ground, Ft.
Up to 50,000	23
Over 50,000	25

RECOMMENDED MAXIMUM SPAN LENGTHS FOR HARD AND MEDIUM HARD DRAWN BARE COPPER WIRE OF SMALLER SIZES

Wire Size, Number	Span Length, Ft
6	150
4	300
2	500

RECOMMENDED TRANSMISSION LINE INSULATION

Line Voltage	10-In. Hewletts Suspension Steel	10-In. Hewletts Suspension Wood	Strain Steel	Strain Wood	Pin-Type Rating All-Wood Construction	Pin-Type Rating Grounded Steel Pins
13,200	2	2	2	2	27,000	35,000
22,000	3	2	3	2	35,000	45,000
44,000	4	3	5	4	55,000	66,000
66,000	5	4	7	5	75,000*	88,000*
110,000	8	..	10	..	.....	.....

* Pin-type insulators not recommended for important lines operating at 66,000 volts.

CLEARANCE FROM LINE TO GROUND AT SUPPORTS—SUSPENSION-TYPE INSULATORS

Line Voltage	Vertical to 15 Deg. Swing—Clearance to Nearest Part of Structure, In.	Minimum Clearance Insulator Deflected 45 Deg., In.
13,200	11	9
22,000	16	14
44,000	22	19
66,000	26	22
110,000	42	36

RECOMMENDED WIRE SPACING ON TRANSMISSION LINES—BARE COPPER WIRE

Pin-Type Insulators—Maximum Span			Suspension-Type Insulators—Maximum Span				
				250-Ft. Spans, Ft.		600-Ft. Spans, Ft.	
Line Voltage	150-Ft. to 200-Ft. Spans, Ft.	600-Ft. Spans, Ft.	Line Voltage	Vertical Arrangement	Horizontal Arrangement	Vertical Arrangement	Horizontal Arrangement
13,200	3	4.5	.....				
22,000	4	5	.....				
44,000	5	6	66,000	6	7	8	9
66,000*	6	6	110,000	9	10	10	12

* Pin-type insulators not recommended for important lines operating at 66,000 volts.

damage to only one insulator—the top one of the string. The second line, having standard construction, underwent one cascade flashover involving all units of one string, the two bottom units as well as the top unit being badly shattered. Although the damage to the insulators was worse on a standard line than on the one equipped with flux control, Mr. Meyer declared that it is too early to draw any conclusions as to the value of flux control.

In conclusion, he reports that no troubles have been experienced on the Navarre-West Warren line, which is protected with a ground wire.

Device for Making Breakdown Tests on Insulating Tapes

BY R. W. CHADBOURN
Department of Standardizing and Testing, Edison Electric Illuminating Company of Boston

UNTIL within a year or so considerable difficulty had been experienced in making breakdown tests on high-voltage tape, such as varnished cambric, because of the difficulty in preventing flashing around the edge of the tape before breakdown was reached. In many cases tapes had been tested under oil, but this had the serious drawback that the oil might seal or partly seal any small defect in the tape. One experimenter, to overcome this, had devised a method that involved clamping a small section of the material between two insulating blocks with small electrodes extending through the blocks. This device had the serious disadvantage of being cumbersome to operate; also it was still necessary to treat the surface of the tape to prevent flashover.

After some experimenting, an apparatus was finally devised at the Boston Edison Laboratory that embodied the fundamental principle of this device—viz., holding the material between solid insulating blocks with enough pressure to prevent flashover around the edge—but that overcame some of the disadvantages and permitted easy and rapid operation. Fig. 1 gives a general view of the apparatus, Fig. 2 showing in detail the chief working parts.

The tape is held between two pieces of fiber, *A*, *A*, which in turn are held between two impregnated wooden blocks, *B*, held in brass bases, *C*. The blocks are pressed together by the spring *D*, which is compressed by the latched handle *E* through a rounded pin, *F*, fitting into a cup-shaped cap *G*. This method of construction prevents sidewise motion of the upper electrode when the handle is depressed. When the handle is released, the blocks are spread apart by two light springs, *H*, mounted on the face of the lower block. This permits drawing the tape sample through to a fresh position. These springs are so placed as to serve for guides for the tape.

The electrodes *J* consist of hollow rods, fitted with very light internal springs, *K*, which hold the ends against the tape surface during test. The ends of the rods are flat, ¼ in. in diameter, with edges rounded to a radius of 1/32 in.

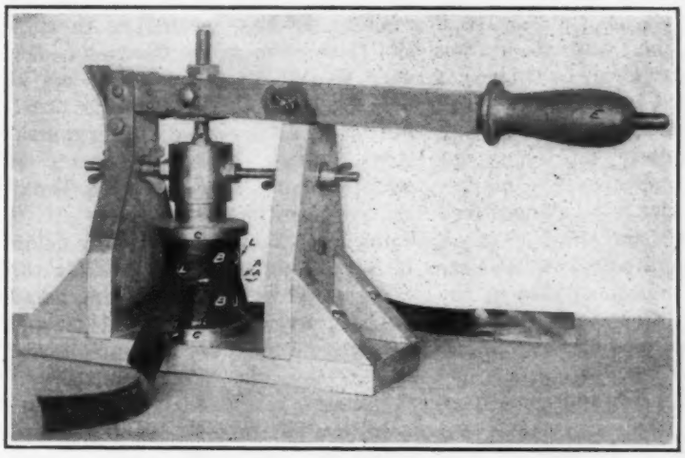
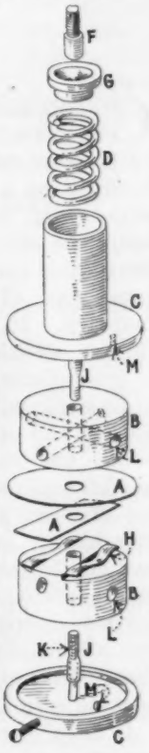


FIG. 1, BELOW—CLAMPING DEVICE FOR TAPE TESTS.
FIG. 2, AT RIGHT—CONSTRUCTION DETAILS OF HOLDER AND ELECTRODES



As more or less arcing usually results at breakdown, it is necessary to relieve the resulting gas pressure in some way in order to prevent creeping around the edges of the tape. This is taken care of by the vents, *L*, in the wooden blocks.

The device operates well without the fiber pieces between the wooden blocks, but it has been found that after considerable use a carbonized path will develop along the surface of one of the blocks and cause flashover of the tape, necessitating resurfacing of the block. This carbonizing and resurfacing is avoided by use of the fiber pieces, which are easily removed and replaced as necessary. In practice, it has been found that a large number of shots can be made before replacement is necessary.

The successful operation of this type of tester depends on the impregnation and surfacing of the wooden blocks and the provision of adequate vent spaces, but these are conditions which are very easily and readily fulfilled.

Cost of 150-Kv. Line in Italy

THE accompanying table shows the distribution of cost on a 150,000-volt transmission line recently erected in Italy. The line was 165 miles long and was built with steel towers, with a telephone line on wood poles paralleling it. There were four conductors, which on certain length of lines were steel-aluminum and in other sections copper, of about 350,000 circ.mil. The total cost of the line was 38,500,000 lire, or about $1,670,000.

COST OF ITALIAN 150,000-VOLT TRANSMISSION LINE

	Per Cent
Survey	1.040
Right-of-way	2.345
Steel—A1 cond.	8.580
Copper cond.	20.500
Ground wire	2.550
Towers	16.100
Insulators	19.500
Telephone wire	1.700
Telephone insulator	0.415
Telephone wood poles	0.650
Telephone apparatus	0.104
Radio telephone	1.322
Switch structures	0.415
Disconnect switches	1.120
Land for switch structures	0.234
Two linemen houses	1.610
Railway transportation of material	4.860
Total material	83.045
Erection of towers	1.870
Ground and concrete work	7.120
Erection of conductors	0.882
Erection of telephones	0.571
Erection of switch structure	0.207
Paints, cleaning, etc.	1.770
Various damages	0.728
Supervision	0.987
Engineering	0.705
Various	1.815
Total labor	16.955

Commercial Activities and Public Relations

Co-operative Competition*

Spells Industry Prosperity—Foundations of Good Will in Electrical Trade—Day for Playing a Lone Hand Is Past—Fair Methods Bring Rewards to All

BY WILLIAM E. ROBERTSON
President Robertson-Cataract Electric Company, Buffalo, N. Y.

CO-OPERATIVE competition may be defined as competition among all merchandising agencies to secure business on a service basis that results from, or is enlarged by, co-operative effort. The prosperity of the central station is the basis of the prosperity of all in the electrical industry. If the central station thrives, all other branches thrive; if it is handicapped in any way, we all are handicapped. The great coming market for electric service is the home, and to capture this market quickly and to secure a balanced load we offer our help and the help of all merchants, manufacturers, dealers and contractors, if the policy of the central-station interests is one that invites co-operation and is chiefly one of helpfulness instead of one that invites criticism and sometimes adverse action.

I have been a member of the executive committee of the National Electric Light Association for five years, have listened to the making of budgets, know intimately the five most recent past-presidents and the next three or four men in line for the presidency; I have heard government ownership and customer ownership discussed and have seen the public relations section appropriate $100,000 or more yearly to build good will. Today the N.E.L.A. is functioning better in its broader aspects than ever before. It is co-operating with Mr. Hoover, with Washington and state public utility commissions throughout the country. It is bringing about appreciation of the facts that proper reserves must be provided to cover obsolescence and that a reasonable return on the investment to serve the public must be assured. Influenced in part by the fiasco of government operation of the railroads during the war, lasting three years and costing the public one and one-half billion dollars, the people of this country are for private ownership under commission regulation.

The Society for Electrical Development has become a living, practical and vital organ of the industry for broadcasting its activities to the public. It has become so through the faith of men like Charles L. Edgar, W. W. Freeman and John F. Gilchrist, who have seen its possibilities and supported the organization through its varied years of certainty and uncertainty. Today the society has "arrived." It is doing important work in many fields. It is building up campaigns for the electric vehicle, for the increased use of electrical refrigeration and for the better development of the fixture and glassware branches of the industry. It is fostering electrical leagues to turn ideas launched nationally into profit locally. Local agencies can and must do this work of intensive sales development.

THE RED SEAL PLAN

The Red Seal campaign has only begun to exert its influence. As an instance of the benefits of the Red Seal plan may be cited the case of a building contractor in Atlanta, Ga., who formerly apportioned $100 per house for wiring. His electrical contractor, made enthusiastic by the Red Seal plan, persuaded him to allow one house to be adequately wired (cost $700) on the Red Seal basis, and the building contractor was so well satisfied that the wiring standard in all houses now built by him is represented by an outlay of $700 or more. The S.E.D. has been and is a vital factor in this trend toward adequate wiring. Highly effective leagues are at work in Cleveland, Chicago and Buffalo. Department stores, fixture dealers, manufacturers and agents, all are working to increase business in the electrical field through co-operative effort and are adding current-using devices to the lines of the central station. So are the ideas back of national campaigns being put to work locally, and much more business can be obtained by all the branches of the industry working together locally than can be had through working alone.

The central station is the logical leader of the industry. It is time for central stations to put men at the head of their commercial departments big enough in caliber to serve on a parity with other leaders. Such men should be made operating vice-presidents and they should "sit in" on questions of policy with other executives. One commercial manager of the wrong type can by a single act wreck the gains of all the money spent by his company over a long period for better public relations. It is a great mistake to look on the sale of merchandise as the measure of success of a merchandising department; it is infinitely more important for the central station to measure the total load put on its lines through the friendly co-operation of all agencies in the electrical community. This total business gained is the real measure of success.

All the efforts of local agencies working together in co-operative competition will put many times more load on the lines of the central station than by the old plan of individual activity. This means fair prices. Cut prices by the central station make a friend of one manufacturer perhaps, but destroy the friendship of all others. In this connection, if the central station gives away lamps, no one can compete in that field. I do not believe the central station should go out of the appliance business. If it is not already in this business and is satisfied with the volume of sales in the community, well and good. There is a large field for central-station activity in financing development work, in striving to secure a balanced load, in championing broad policies of co-operation. The leadership and co-operation of this branch of the industry are worth more than is easily evaluated. A few years ago central stations were obliged to do wiring because there were no wiring contractors. Now this work can be done by contractors and the

*From an address before the Metropolitan Electrical League of Boston, Jan. 8, 1926.

central station is gradually dropping out of the field. Refrigeration and heat applications still need preliminary work in development.

The trend of the times is illustrated by such acts as that of the General Electric Company in voluntarily divorcing, as a matter of sound policy and not as a matter of law, its Electric Bond & Share holdings from the parent company and that of the American Telephone & Telegraph Company in establishing the Graybar Electric Company in place of the Western Electric Company's jobbing division. This trend is in the direction of permitting competition on a fair basis, which means through co-operation and on equitable terms. The central station profits forever when appliances are added to its lines, and its natural leadership implies the giving of more time and money to development work than can be expected from the jobber and contractor, but these last should do their part, expending time and money to put goods into service on central-station lines.

In my opinion, no central-station commercial department manager should be allowed to enter into competition on a price basis with any customer of the company. It is unsound from every viewpoint. All merchants are customers of the company. Some of these merchants in many lines endeavor to sell current-using devices. Every time the company sells anything at cut price or on absurdly long terms every merchant is irritated, if not aggressively "mad." Why antagonize, when you can use them and have them happy in serving you, helpful in protecting your interests, when attacked, Mr. Central-Station Manager? Your customers' purchases of newspaper advertising space make yours look insignificant by comparison; their influence with local publishers is large, either to help or to hurt, and their influence with public officials and legislators, city, state and national, is not inconsiderable. Why not have it with you? If you sell on deferred terms and payments are slow, never allow an employee to threaten discontinuance of service for this cause. It is unfair to other intelligent merchants, and besides, the central station was never granted that right, and every delinquent on whom that kind of an argument is used becomes a bolshevik so far as the central station is concerned.

We who desire intelligently to serve the industry should find a way everywhere to solve our problems with open minds and through co-operative competition build prosperity for all in the electrical field. Our problems can and will be solved in this spirit and on this basis.

Commercial Lighting Campaign

BY G. B. FOSTER
Washington Water Power Company

SELLING 660 lighting units to 244 customers, the Washington Water Power Company, Spokane, Wash., had a successful commercial lighting campaign in the late weeks of 1925 and has compiled an exhaustive analysis of its first attempt in a campaign of this kind.

All commercial salesmen were used in the drive, organized in two teams. Of the 660 units placed on trial, all but 71 were taken by the customers. William Matthews, illumination engineer, supervised the field work and made a creditable sales record himself. Following a very gratifying campaign earlier in the year in the sale of home kitchen units, the Washington Water Power Company's first attempt at a commercial campaign not only resulted in a good sales record but went a long way in educating the commercial customers to the use of better lights in their establishments. The average of 320 watts per fixture and an actual connected load of all lighting equipment sold and installed of 189.65 kw. are seen in the campaign results.

It has been closely determined that at least 85 kw. was added to the load, which should produce a revenue of at least $3,200 per year. This revenue of $40 per kilowatt-year compares quite favorably with the electric range in dollars per kilowatt of demand, a point not ordinarily considered with a lighting load.

In the campaign salesmen were allowed $1.50 commission on each unit sold except for those men on a flat salary basis. The average cost of a unit installed, including inspection, commissions, lamp for unit and all expenses to the company, was

ONE OF THE ARGUMENTS USED IN THE WASHINGTON WATER POWER COMPANY'S LIGHTING CAMPAIGN

Daylite units almost made a new store of this Spokane, Wash., establishment after the salesmen of the Washington Water Power Company had installed eight new lighting units. The views were taken with the same camera, and each was exposed three minutes by the lights seen in the picture, without assistance, and show the definite results of such a lighting campaign.

$12.16. The cash selling price was $11.73 or $12 on easy terms.

The detailed statements of costs and return for the campaign which accompany this article show an average cost to the company of 43 cents for each unit installed. This cannot in any sense be regarded as a loss because not only is it returned in additional revenue but it can very justifiably be considered an expense of consumer education, as is evidenced by the fact that the company has received an average of one call per day requesting illumination advice from stores, offices and factories since the campaign closed.

COST SUMMARY

Item	Cost	Cost per Unit
1. Fixtures and installation of same	$4,536.39	$7.69
2. City inspection charge	102.50	.18
3. Advertising, demonstration store displays, printing and photographs	1,555.92	2.64
4. Cancellations, cost of installation and removal	35.25	.06
5. Commission for sale	883.50	1.50
6. Miscellaneous expense (estimated)	50.00	.09
Total cost	$7,163.56	$12.16
Cash selling price	6,909.75	11.73
Difference	$253.81	$0.43

EXPOSITION OF COST SUMMARY

Item No. 1.—Includes, besides the cost of the merchandise, the electrician's charge for installation, which was slightly in excess of 75 cents per unit due to some extra work required before fixtures could be installed. No wiring was done by the company, but $726.50 worth was installed by the electricians employed. This business, which amounted to $1.23 per unit, was more profitable than was at first expected.

Item No. 2.—Is 50 cents per customer less three orders going outside of the city.

Item No. 3.—Includes newspaper, direct mail and demonstration advertising. Newspaper space was 1,124 in. in twenty displays in the three local papers. Advertisements were run on the first five days of the week, none appearing on Fridays or Saturdays. Three demonstration stores were equipped with fixtures and a show window was decorated and properly lighted during the campaign. The demonstration stores were a great help to the salesmen, who could show a prospect just what his neighbor had done to improve his lighting. Other demonstration stores were equipped with fixtures only. Two multigraphed letters were sent out, each with a return post card, to a selected list of about 3,000 names. These letters were personally addressed by typewriter and signed in ink. Many replies were received to both letters and nearly every customer replying was sold. The expense of sending out these letters and post cards was only about 4 cents each.

Item No. 4.—Was the cost of removing fixtures installed but canceled for one reason or another, mostly due to improper location and high bill complaints.

Item No. 5.—Is based on a straight commission of $1.50 per unit which was paid to seven of the salesmen, the five others being on a straight salary basis. These latter men carried on their regular duties as well as canvassed for this campaign, hence their salaries could not be charged to the campaign entirely. However, the commission would represent about 60 per cent of their salaries, which is liberal. Prizes were offered for a team selling their quota (375 units).

DISTRIBUTION OF UNITS AMONG BUSINESS CLASSES

	No. Customers	No. Units
Auto sales and supplies	9	37
Barbers and beauty parlors	9	27
Bakeries	8	23
Banks	3	11
Cigar stores	5	10
Confectioneries	9	28
Churches	1	4
Drug stores	6	15
Electrical	2	4
Factories	7	16
Florists	1	2
Furniture stores	7	18
Gas stations	4	7
Groceries	40	109
General merchandise	6	35
Hotels	7	37
Hardware stores	1	1
Jewelry stores	9	19
Junk dealers	1	1
Laundries	2	7
Leather stores	1	2
Men's clothing and haberdashery	10	38
Offices	23	43
Printing shops	7	24
Poolrooms	1	1
Plumbing	2	5
Restaurant and lunch	12	38
Shoe repairs	7	15
Seed stores	1	4
Tailor shops	7	8
Net totals	208	589
Cancellations	36	71
Total sales	244	660

STATEMENT OF SALES

Each horizontal line of figures represents the work of one salesman

Week of Sept. 25		Week of Oct. 2		Week of Oct. 9		Week of Oct. 17		Closing Week	Total Period		Units per Customer
Customers	Units	Customers	Units	Customers	Units	Customers	Units		Customers	Units	
5	20	6	26	12	26	26	66	10	49	148	3.0
2	3	0	0	4	11	5	22	No Can-	11	36	3.3
2	3	9	15	7	15	19	31	vassing	37	64	1.7
1	1	3	17	4	9	5	13	in this	13	40	3.1
0	0	1	4	3	7	10	25	week	14	36	2.6
2	4	3	6	2	3	3	14	6	10	53	3.3
2	3	5	22	3	5	4	16	..	14	46	3.3
0	0	1	6	3	4	6	21	..	10	31	3.1
2	2	4	9	7	7	8	21	..	21	39	1.8
2	4	1	1	10	19	5	23	..	18	47	2.2
1	9	2	12	1	6	5	31	10	10	68	6.8
0	0	0	0	0	0	1	1	..	1	1	1.0
Totals and Grand Totals											
19	49	35	118	56	112	98	284	26	..	..	...
..	..	54	167	110	279	208	563	589	208	589	2.8

Guard Prevents Children from Climbing Poles

THE accompanying illustration shows an effective method used by the Louisville (Ky.) Gas & Electric Company to prevent accidents to children resulting from their climbing poles and coming in contact with live electrical conductors. A cone-shaped shield approximately 3 ft. in diameter is attached to the pole below the first step about 12 ft. from the ground. A lineman with the aid of his spurs can easily step over the shield and reach the steps on the pole, but it is impossible for a boy bent upon climbing to get beyond the guard.

CONE-SHAPED GUARD USED ON POLES NEAR PLAYGROUNDS AND CHILDRENS' HOMES

Use of these shields on the Louisville company's poles has been restricted to installation in localities near schools, playgrounds and orphans' homes, where experience has shown that most accidents occur to children from surreptitious pole climbing.

Digest of Electrical Literature

Transmission, Substations and Distribution

Small Chain-Type Insulators. — W. WEICKER.—The many advantages of chain-type insulators for transmission lines of very high voltage are sometimes desirable also for networks of low and medium voltage. Attempts to benefit by them were made, soon after the introduction of the now standard suspension porcelain ware, by using only two or three units. However, it was found that these units, which are designed for a much heavier duty, are out of proportion to the relatively small conductors usually employed for medium-voltage transmission. A large German ceramic firm has recently introduced lines of suspension insulators patterned after the standard line but on a much smaller scale. For example, chain units weighing only 4 lb. each are now available, corresponding to high-voltage-type units weighing 12 lb. each. Special light-weight hardware is available to fit installations of these small chain insulators. In spite of their much reduced size, their strength has not been materially lessened, as is illustrated by the fact that to break these units requires from 6,000 lb. to 8,000 lb. pull. Several examples of the various available types of these new insulators and pictures of their installation are included. — *Elektrotechnik und Maschinenbau*, Dec. 13, 1925.

Units, Measurements and Instruments

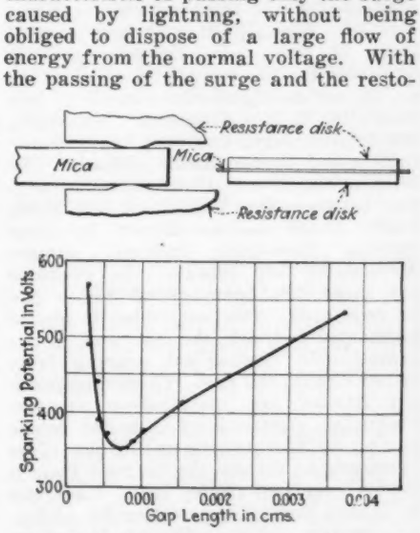
New Edition of A.I.E.E. Standards. —F. D. NEWBURY.—This paper outlines some of the more important changes that have been made in the Institute standards, twenty sections of which have been published out of a proposed total of more than forty, each dealing with one major type of machinery or apparatus.—*Journal of A.I.E.E.*, January, 1925.

Temperature Measurements.—A preliminary draft of the portion of the A.S.M.E. Test Code on Instruments and Apparatus dealing with temperature measurements has been published. In it some sources of error in the customary methods of measuring temperatures of fluids differing widely from that of their surroundings are pointed out, with suggestions for improvements. In place of the smooth-walled thermometer well one with fins will tend toward a better flow of heat through the wall. For the filling liquid, mercury can be used up to 500 deg. F., solder from 500 deg. to 1,000 deg., tin from 600 deg. to 1,800 deg. When the bare leads of thermocouples or resistance thermometers have to pass through a region of different temperature, the conduction of heat to or from the device can be minimized by running them for some distance through an isothermal zone.—*Mechanical Engineering*, December, 1925.

Study of Time Lag of the Needle Gap.—K. B. MCEACHRON and E. J. WADE. — The Dufour oscillograph affords a means for analyzing extremely rapid electrical phenomena, time intervals of the order of a microsecond being measurable. The trace of an electron stream is swept across the photographic film within the vacuum chamber, the displacement due to the phenomenon under investigation being superposed on the motion caused by a high-frequency oscillation used as a base line. The application of the Dufour instrument to the study of the needle gap is described and records obtained with its aid are reproduced. A steep wave front was obtained by the discharge of a condenser through a resistance and gap. Under certain conditions an oscillation appears superposed on the wave-front. One of these, of 20,800 kilocycles, is shown. As to the needle gap, it is shown that with any given setting and sparking voltage the lag varies through wide limits—for example, in one case between 21 and 491 microseconds—and that increased gap settings mean increased lag.—*Journal A.I.E.E.*, January, 1926.

Generation, Control, Switching and Protection

Theory of the Auto-Valve Arrester. —JOSEPH SLEPIAN.—Lightning arresters of the valve type, being substantially non-conducting below a definite critical voltage, have the advantageous characteristic of passing only the surge caused by lightning, without being obliged to dispose of a large flow of energy from the normal voltage. With the passing of the surge and the restoration of normal voltage the discharge ceases. The amount of energy to be dealt with is therefore relatively small. The essential element is a barrier which breaks down on the application of a quite definite critical voltage. Generally the barrier consists of a thin film. In the auto-valve the film is a layer of air next to a cold cathode which is the seat of the cathode drop in a glow discharge. With the application of sufficient voltage this film becomes highly ionized, but the discharge of the ions into the electrodes and recombination promptly restore the normal resistivity when the voltage is reduced. To avoid a concentration of current at one point, which would quickly become heated and thus convert the discharge into an arc, the electrodes are made of carbon. The resistance of this material effectively controls the distribution of current. In his paper the author discusses the action in detail, in the light of experimentally determined curves such as the one here reproduced, from which the reason for using very short gaps is evident. By using mica spacers the need of making so minute a gap as 0.0003 in. is avoided; the field distortion at the edges of the mica, even with a gap of 0.003 in. to 0.005 in., being such as to cause breakdown to occur at less than 400 volts per gap. The construction of one element of the arrester is shown diagrammatically herewith, the upper left portion of the figure being a highly magnified detail. — *Journal A.I.E.E.*, January, 1926.



DETAIL OF DISCHARGE GAP AND CURVE OF SPARKLING POTENTIAL

Illumination

Lighting of Show Windows During Daylight Hours.—O. R. HOGUE, CHARLES HOWARD and E. D. TILLSON.—A window 14 ft. wide by 6 ft. deep by 8 ft. head room was set up in Chicago and loaned to merchants for periods of two weeks each. The window was originally provided with one row of ceiling outlets containing 100-watt lamps on 12-in. centers, with silvered glass reflectors. This illumination was doubled and the ceiling outlets placed on alternative circuits, so that the lamps could be either flashed or fixed. In addition ten 400-watt spotlamps were used. With this equipment varied effects were secured. The intensity was high enough to attract attention by daylight. In addition, the effect of motion was generally introduced, either by the play of light or by mechanical movement. The paper describes a number of displays, including millinery, drugs and toilet articles, men's clothing, books, women's hosiery and optical goods. For displaying large, dark objects silhouette lighting was resorted to. This was found to be more effective than attempting to illuminate the objects themselves to the necessary brightness. Details are given on methods of securing the lighting effects and the motion. Counts at several different hours of the day show that from five to twelve or more times as many passers-by stopped at the window in question as at adjacent windows, which were of average attractiveness.—*Transactions I.E.S.*, December, 1925.

Reflection Properties of Chromium.— ROBERT J. PIERSOL. — The advent of floodlighting and automobile headlighting calls for a metallic reflector which is not subject to corrosion, has a surface sufficiently hard to resist scratching when being cleaned and maintains a high coefficient of reflection throughout its life. With these requirements in mind, different types of metallic reflectors are reviewed. Silver plate on the back of glass has a high coefficient, about 92 per cent, but the reflec-

tor is fragile and the cost increases rapidly with the size. Silver plate on a baser metal, making in effect a silver mirror, has initially a still higher coefficient, about 95 per cent, but to prevent tarnishing it is coated with lacquer, which reduces the coefficient by as much as 20 per cent. In a comparatively short time the lacquer darkens, thereby reducing the reflection to less than half its previous value. Freshly polished nickel begins with only 60 per cent, which is soon lowered by tarnishing. The surface is soft and becomes scratched in cleaning. Silver alloys containing silicon, antimony, cadmium, copper, zinc, magnesium, tellurium and other metals in small quantity in various combinations were found to be efficient reflectors, but were darkened at the operating temperature of floodlamps. Compared with these, a chromium surface has a good combination of desirable qualities. It can be highly polished. Though the metal itself is extremely brittle, it is very ductile when plated as a thin coat and has excellent adhesion to a base such as copper or iron. The surface is of tool-steel hardness and can be wiped with gritty waste without scratching. Accelerated life tests at 300 deg. C. gave no indication of tarnishing. The initial coefficient of reflection is about 65 per cent and remains high. As to corrosion, it is not attacked by sulphur fumes and water vapor, which is the chief cause of tarnishing of silver and its consequent failure as a reflecting medium.—*Transactions I.E.S.*, December, 1925.

Residence Street Lighting.—A symposium is presented giving twelve solutions of a street-lighting problem for the residence section of a city of more than 100,000 population. The table

SOLUTIONS OF STREET-LIGHTING PROBLEMS

Solution No.	Cost per Mile (per Cent of Ave.)	Illumination Values (Lum./Ft.)	Size Incand. Lamps (Lum.)	Mounting Height (Ft.)	Spacing (Ft.)
1	158	30—40	4,000	11½	120 S‡
2	49	13	2,500	11	196 O‡
3	....	19.3	200†	16	124 S
4	154	25	2,500	12	100 S
5	74	20—25	3,250	16	155 S
6	68	0.03—0.07*	2,500	15	150 S
7	65	16.6	2,500	16	150 S
8	87	22	2,500	14	130 S
9	38	0.03—0.20*	4,000	25	273 C‡
10	97	20†	2,500	11	115 S
11	222	50	4,000	13	80S
12	89	20	2,000	12½	100 S

*Foot-candles. †Watts. ‡S, staggered; O, one side; C, center span.

summarizes in part the essential features of all the solutions. Illustrations accompany the solutions.—*Transactions I.E.S.*, December, 1925.

Electrophysics, Electrochemistry and Batteries

Magnetic Power Losses.—C. E. WEBB.—A detailed survey of reported investigations on the hysteresis losses of sheet steel shows general agreement on the exponent 1.6 in Steinmetz's empirically determined law for flux densities between 4,000 and 10,000, but at higher densities surprising differences exist in the results found by different investigators, some confirming the same exponent up to 20,000 or 22,000, others giving values ranging up to 3 or more. Tests were therefore made to determine the reasons for this variation. The results are thus summarized: (1) In all the principal types of commercial sheet material in use at the present time the rate of increase of the hysteresis loss with B is considerably greater at flux densities above $B = 10{,}000$ than is indicated by Steinmetz's law or than appears to have been generally realized. In most specimens over a small range in the neighborhood of $B = 15.000$ the variation is as rapid as the 2.5th power of B, and in some cases it exceeds the third or even the fourth power of B. (2) Above about $B = 16{,}000$ the rate of increase falls off very rapidly and drops again to the 1.6th power or even lower. (3) The eddy-current index at high flux densities is fairly constant and generally rather less than 2. (4) The apparent values of hysteresis and eddy-current losses in ordinary commercial sheet material depend to a considerable extent on frequency, seemingly due to the non-homogeneity of the sheet. These effects do not appreciably alter the exponents which were observed.—*Abstract of I.E.E. paper in Electrician (England)*, Jan. 1, 1926.

Traction

Motor Cars for Montreux Railway (Switzerland). — A. BRODBECK. — The paper gives a detailed description of the latest types of electric motor cars placed in service on the 40-mile railway from Montreux to the Berner Oberland, catering primarily to tourist travel. A number of adverse conditions make this road one of the most difficult in Switzerland. Being built with only a yard gage (1 m.), very limited space is available for the motors. Grades of up to 7.2 per cent and curve radii of less than 100 ft. are frequent. Unusually low temperatures and very heavy snowfalls make winter traffic difficult. The road operates on direct-current varying between 600 volts and 900 volts. Each motor car is driven by four 144-hp. (one-hour rating) motors. Articulated air intakes are provided for these, the openings of which can be regulated. One controller is placed horizontally under the car and is operated with mechanical gearing from either end of the car. Three independent brakes are installed—a vacuum brake, an electrodynamic motor brake and an electromagnetic rail brake. Two pantographs collect the current from a double overhead trolley line. Each car is heated during the winter by 15-kw. air heaters.—*Brown-Boveri Mitteilungen*, December, 1925.

Diesel-Electric Railway Cars. — Attention was recently called to a Diesel-electric car which had successfully accomplished a record non-stop run on the Canadian National Railways. Some details are now given. The main generators are designed for 600 volts, 105 kw., for two hours, with a 50-deg. temperature rise, or 85 kw. continuously with a 40-deg. rise, at 700 r.p.m., and are provided with overhung exciters rated at 6 kw., 60 volts. A battery of 480 amp.-hr. capacity, charged by the exciter when running, carries the lighting and other small loads. The main generators are provided with three windings on the main poles—(a) one for separate excitation from the battery, (b) a winding connected in series with the battery across the exciter terminals, (c) a differential series winding carrying the generator output current. The resulting drooping volt-ampere characteristic causes the demand upon the engine to be substantially constant over the working range. On steep grades the high current for the needed high torque is delivered at low voltage, and therefore the speed is low. At small loads the engine speed rises, making the voltage about 900 at no load. The characteristic, as shown on a chart, is nearly a straight line, falling to some 350 volts at 300 amp. (roughly twice rated current).—*Electrician (England)*, Jan. 1, 1926.

Miscellaneous

Electric Power in Great Britain.—R. A. CHATTOCK. — The title selected for this digest indicates in a general way the subject of the inaugural address of the president of the I.E.E. It is a review of certain aspects of the power situation in his country. He first calls attention to the report of the Electricity Commission as embodying an enormous amount of statistical information of great value to electricity supply engineers. As to fuel, 95 per cent of the units generated in the country are derived from steam-operated plants, practically all using coal or coal products. The economy of such stations, he points out, should not be judged on the basis of the weight of coal per unit generated, but rather on its cost, since a plant consuming a large weight of low-grade fuel may operate more cheaply than one operating on high-grade fuel. This will apply particularly if the distillation of coal proves a success, since in that case the returns from the sale of byproducts should be credited. Pulverization offers opportunity for further economies, among them the possibility of installing individual boilers having capacities up to 300,000 lb. of steam per hour, sufficient to run a 25,000-kw. turbine. The low load factors in British plants, between 15 and 30 per cent in the majority of cases, are contrasted with load factors of 45 or 50 per cent on big systems in America. A tabulation shows the decrease in Birmingham from 39.1 per cent in 1917 to 26.0 per cent in 1925, due to unfavorable changes in manufacturing conditions and the increased residence lighting load. One suggested remedy is to foster the cooking and heating load. The advantages of standardizing 50 cycles as the one frequency are reviewed and set over against the cost of the change in those districts now operating on other frequencies, estimated at £27,000,000 ($130,000,000). The conclusion is that the gain is not worth the cost. Finally the address discusses the training of engineers for supply undertakings; not less than three years should be spent at a technical college after leaving school, then at least two years at practical work in a large engineering manufacturing plant. — *Journal I.E.E. (England)*, December, 1925.

News of the Industry

Another Philadelphia Cut

Electric Company's Rates Voluntarily Reduced for Fourth Time in as Many Years

FOR the fourth time in four years the Philadelphia Electric Company has made a voluntary reduction in its rates for electric light and power. This reduction, as advertised in the Philadelphia press on Saturday, Jan. 30, will (1) reduce for residence customers the number of hours' use necessary to drop from the 7-cent rate to the 3-cent rate, (2) reduce for retail lighting customers the number of hours' use necessary to drop from the 8-cent rate to the 6-cent rate and from the 6-cent rate to the 3-cent rate, (3) reduce for retail power customers the number of hours' use necessary to drop from the 7½-cent and 5½-cent rates to the 5½-cent and 2½-cent rates, (4) bring for wholesale power customers a reduction of rate in all blocks of the standby charge of 25 cents per kilowatt, (5) bring for untransformed power service a reduction of rate in the first block of 25 cents a kilowatt, and (6) bring reductions in the standby charges made for public utilities, urban and suburban transportation, railways and similar service.

Previous voluntary rate reductions were made by the Philadelphia Electric Company in 1922, 1923, 1924 and 1925. The company says:

"This fourth voluntary reduction in rates for electric service represents a direct saving of approximately $1,500,000 annually to Philadelphia. Considered in connection with the three previous reductions, it represents a cumulative saving to our customers of $13,400,000. This reduction in rates is of greatest benefit to the small customer —the residence user, stores and offices. Large power users, because of increased volume and density of business, receive substantial savings. In the past year, through the operation of the coal clause, they have benefited materially and will continue to do so during 1926 through the operation of the same clause. Because of the large sums of money being spent by the company in voluntarily changing over the street-lighting system, it has not been possible to make any reduction in the rates for this class of service."

In concluding a more detailed statement President W. H. Johnson says: "We are now not only furnishing and will continue to furnish energy in large blocks to the other public utilities of the city, but we are also furnishing, through interconnection, very large blocks of energy to neighboring electric light and power utilities in this state and in New Jersey. It is with all these things in view and with the desire of obtaining an added economic advantage for the public that we are endeavoring to utilize the only water power available in this section at present, at Conowingo, and at the same time laying our plans to complete the colossal Richmond station on the Delaware River. These accomplishments would not have been possible without the heartiest cooperation of our customers and the community which we serve."

New Jersey Inquirers Hostile to Delaware Treaty

Rejection of the tri-state compact between Pennsylvania, New York and New Jersey for the control of the water and power resources of the Delaware River has been recommended in a report of the New Jersey Water Policy Commission to the Legislature of that state. The commission recommended, however, that the negotiations be continued and that a bi-state commission be created to negotiate a compact between New Jersey and New York defining their respective rights to interstate streams.

Last year the treaty arrived at by commissioners from the three states was accepted by New York and Pennsylvania, but deferred by New Jersey, whose Legislature appointed a commission to inquire into the subject. It is this commission which has just made the hostile report.

Conowingo Hearing in Baltimore Next Friday

The Federal Power Commission at its meeting on Jan. 29 authorized its executive secretary to hold a public hearing in Baltimore on Friday, Feb. 12, to consider the federal questions involved in the issuance of securities in connection with the Conowingo development. This hearing will follow one on the same subject to be conducted by the Maryland authorities.

St. Louis Interests Buy Large System in Mexico

One of the largest industrial transactions that have taken place in Mexico for several years is the purchase by the Morrison-McCall interests of St. Louis of the hydro-electric plant and other holdings of the Compañia Electrica del Chapala of Guadalajara, for a reported consideration of $20,000,000 (United States money). The power system of the company extends to Guadalajara and to towns and mining camps within a radius of 110 miles. The new owners plan to enlarge the hydro-electric plant and extend the transmission system. Their development program also includes the prospective purchase of a number of electric light and power plants in the larger towns of this part of Mexico, including those of Manzanillo, Tepic and other municipalities on the Pacific Coast, it is said. The Morrison-McCall interests formerly owned the Texas Central Power Company, which they sold last summer to the Middle West Utilities Company of Chicago.

Samuel Insull as Prophet

Chicago Executive Visions Railroad and Farm Electrification to Come in Mississippi Valley

SAMUEL INSULL, opening speaker before the Midwest Power Conference in Chicago last week, in reviewing the phenomenal progress of the electric light and power business and briefly sketching its present development in the Mississippi Valley, ventured also into the realm of prophecy. Quoting extracts from his own speeches in the last thirty years, he showed that his persistent optimism regarding the future of the business had been continually justified by the event and even more quickly than he had expected.

Eighty-five per cent of the Mississippi Valley systems, Mr. Insull said, involving fourteen major companies, are now interconnected and sales of energy amounting to $525,000,000 were made by them in 1924. Only 8.7 per cent of the output was developed by municipal plants and 6.2 per cent by industrial plants. In this district is the longest interconnected system of transmission lines under one management, that of the Insull systems, extending from central Wisconsin, through Chicago, a central Indiana mine-mouth plant, a steam station on the Ohio River, the water-power plant on Dix River and a mine-mouth plant in West Virginia, a total of 730 miles from end to end. To the moving spirits in interconnection elsewhere, which has usually involved properties under different ownerships, Mr. Insull, however, generously accorded the palm. The technical, financial and economic advantages of interconnection, he said, outweighed considerations of territorial rivalry.

Outstanding advantages of interconnection were enumerated as including increased diversity in character and time of load, improved load factor, better reliability, better unit investment and reduced operating and depreciation expenses. Such cost reduction must be followed ultimately by reduced prices to the customer, Mr. Insull declared, because charging too much is just as uneconomical as charging too little.

Looking into the future, Mr. Insull prophesied that when the ordinary voter realizes that the opportunity must be given to steam railroads to establish first-class credit railroad electrification will come about more rapidly. If electrification is economical to the Chicago, Milwaukee & St. Paul in the sparsely settled mountainous country, it would be just as economical in the more thickly populated Mississippi Valley. The speaker recognized the magnitude of the investment required, reiterating that the solution of the problem lies chiefly in credit standing. If the 130,000 miles of railroad in the Mississippi Valley were electrified, they would require almost the equivalent of

the present output of utilities in that section. Such electrification would save 75,000,000 tons of coal a year.

Only 6½ per cent of the farms in the Mississippi Valley have electric service now, Mr. Insull said. If all of them were electrified, the rural load alone would increase central-station output 50 per cent—an estimate based on the use of present energy-consuming devices and not taking into account the business which would come from increased wealth resulting from increased use of power. All of this business could be handled with relatively small increase in generating-plant investment.

J. B. McCall Dies Suddenly

Chairman of Philadelphia Electric Company Board Had Long Guided Growth of Central-Station Business in the Quaker City—Worked His Own Way Up

AFTER four years of ill health, death came suddenly to Joseph B. McCall, chairman of the board of directors of the Philadelphia Electric Company, who expired on Friday night, Jan. 29, at the Hotel Traymore, Atlantic City, a few moments after chatting with his family. Mr. McCall was president of the Philadelphia Electric Company from its inception in 1899 until his resignation in June, 1924, because of the condition of his health, to accept the chairmanship of the board. Under his guidance the company had grown to its position among the greatest electric light and power systems in the world with a financial standing second to none. He was a leader along many lines of central-station enterprise, very conspicuous being his attitude and example in promoting loyalty and *esprit de corps* among the company's employees and friendly relations with the public and his readiness to make at every reasonable opportunity voluntary reductions in the rates paid by customers. His death in his fifty-sixth year removes prematurely a man whom his associates, colleagues and fellow citizens delighted to honor. Overwork, particularly during the period of the war, to which was added grief for the loss of a son killed at Chateau Thierry, is believed to have caused the failure of his health. The immediate cause of his death was dilatation of the heart.

JOSEPH B. MCCALL

MR. MCCALL'S CAREER

Joseph Benton McCall was born in New York City on May 12, 1870, removing to Philadelphia with his parents while a child. He left school at the age of fifteen and at sixteen started to work as office boy for the Pennsylvania Globe Gas Light Company, working his way up to be secretary. Under his early chief, Martin Maloney, McCall helped in 1895 to organize the Pennsylvania Heat, Light & Power Company, of which he became secretary and treasurer. This company, with which was united the Edison Electric Light Company of Philadelphia, took over city contracts for street lighting. Two or three years later it was absorbed by the Pennsylvania Manufacturing Light & Power Company, and Mr. McCall was made head of the new organization.

In December, 1902, a franchise was granted by the city to the Philadelphia Electric Company, into which the Pennsylvania Manufacturing Light & Power was merged. Mr. McCall, not yet 33, was elected its first president and proceeded with a plan of uniting the thirty-two independent electric companies then operating in various parts of the city at varying voltages and frequencies. It was due to his efforts that the many complex engineering and commercial problems were surmounted and the unification of the supply of electricity to consumers in Philadelphia became a fact. During his years as head of the company it grew to be one supplying four hundred thousand users of electricity, with more than seven thousand employees. Three huge generating plants were constructed — Schuylkill, Chester and Delaware—and the even bigger Richmond station was started. A vast network of underground and overhead transmission and distribution lines sprang into being.

In the years of the World War the company supplied the bulk of the power used by the great shipyards and munition plants in the Philadelphia district. Furnishing uninterrupted energy to these plants and financing the erection of new generating stations placed a load on Mr. McCall's shoulders to which few men would have proved equal and under which he eventually weakened. His illness assumed a serious aspect when he collapsed after playing a game of golf in April, 1922, but be continued in direct charge of the company's operations until a year and a half ago, Walter H. Johnson then succeeding him as president.

Mr. McCall was a prominent figure in the Association of Edison Illuminating Companies, of which he served as president from 1904 to 1907. In 1913, after serving as vice-president, he was chosen to be president of the National Electric Light Association, his balanced character, constructive ability and untiring energy making his administration rank high among the many noteworthy terms of office chronicled in the history of that organization. He was also, though not an engineer, an associate of the American Institute of Electrical Engineers, and he belonged to the famous Franklin Institute of Philadelphia as well as to various social and athletic clubs, including the Merion Cricket Club, cricket having been a hobby of his younger days, afterward superseded by golf.

Mr. McCall was too fully absorbed in building up the Philadelphia Electric Company to concern himself very intimately with outside business interests, though he served as a director of the First National Bank of Philadelphia, the Provident Trust Company, the Philadelphia & Reading Coal & Iron Corporation, the Guarantee Trust Company of North America, the Electrical Testing Laboratories of New York and other concerns. In 1908 he was made a Presidential elector by the Republican party, voting for President Taft.

Mr. McCall had a remarkable personality and the gift of making and retaining friends, founded in part on a retentive memory for faces and names. He won the affection of his employees, whom he liked to call his "gang," and received the loyal support of his fellow executives. He was instrumental in establishing a country club for the employees of the company. This club was named for the son killed in the war. In one of the editorial tributes paid to him by the Philadelphia newspapers he is described as "not only a distinguished captain of industry, but also a man of rare social charm, a 'fellow of infinite jest' and a warm-hearted, considerate friend." Besides his widow, who was Lenore Adah Guest, a son and a daughter survive him. The funeral took place in Philadelphia on Tuesday from the Church of the Saviour.

Leaders of the Industry Pay Warm Tributes

Mr. McCall's death brought forth warm expressions of regret from the leaders of the electrical industry in every part of the country, who were quick to voice the loss the industry has suffered and to praise his memory both as the outstanding executive and as the personal colleague and friend. A very few of these tributes, telegraphed at the request of the ELECTRICAL WORLD, are printed below.

From CHARLES L. EDGAR, *president Edison Electric Illuminating Company of Boston:*

"Our industry has suffered a great loss in the passing of Joseph B. McCall. He built up a great company, which stands as a monument to his ability. His judgment of men and things and his courage in always standing for what he thought to be right were his outstanding characteristics. His wonderful personality endeared him to all his friends. Personally I shall miss him very much."

From W. W. FREEMAN, *president Union Gas & Electric Company, Cincinnati:*

"Joseph B. McCall was one of the most prominent and beloved personalities in our industry. He was unique in combining great ability with untiring industry and a personal charm and friendliness which his host of friends will ever remember with admiration and affection."

From W. S. BARSTOW, *president General Gas & Electric Corporation, New York:*

"The sudden death of Joseph B. McCall came as a shock to his many friends. Those who enjoyed his friendship admired in him ever the true gentleman and the man who solved every business problem with balanced judgment. He leaves, among the many successes of his active business life, as the greatest monument to his genius the Philadelphia Electric Company."

From GUY E. TRIPP, *chairman of the board of directors of the Westinghouse Electric & Manufacturing Company:*

"There are many who will regret the death of Joseph B. McCall, but there is an ever-narrowing circle of pioneers in the electric industry who will be oppressed with sorrow. To them the plain facts of his participation in the work of developing a new and great industry are endowed with a life which was a part of him and is a part of them. The chapter of his life has been written upon the hearts of those old associates who survive him, and no recital of his ability, his achievements, his loyalty, his unfailing optimism and cheerfulness can add to the stature of 'Joe' McCall as he lives in their memories."

From E. W. RICE, JR., *honorary chairman of the board of directors of the General Electric Company:*

"By the passing of Joseph B. McCall the electric light and power industry has lost a courageous, inspiring, wise and tactful leader, and his host of friends will treasure as long as they live the memory of a strong, magnetic and charming personality."

From OWEN D. YOUNG, *chairman of the board of directors of the General Electric Company:*

"Joseph B. McCall won a special and peculiar place among the few great leaders of the electrical industry. His personality was mellow and compelling, his judgment was broad and wise; his understanding was comprehensive of things outside of the art as well as in; his sympathy was wide and all-embracing. He will be greatly missed at our councils and in our friendly gatherings."

MR. JOHNSON'S EULOGY

Walter H. Johnson, president of the Philadelphia Electric Company, who for the greater part of his career has been intimately associated with Mr. McCall in the operation of the Philadelphia Electric Company system, was too stunned by the shock of Mr. McCall's death to give adequate expression to his feelings.

"Mr. McCall and I," he said, "have worked side by side for more than thirty-one years in building up the Philadelphia Electric system. We planned together, fought together, played together, and I need hardly say what a great personal loss I have suffered by his death. Every man connected with the Philadelphia Electric Company, whether he be a director, an officer, a lineman or a clerk, feels the same sense of loss, because Mr. McCall was greatly beloved and admired. Through his death the electric light and power industry has also been bereft of a great friend and adviser. Mr. McCall knew better than most men the electric light and power business and its possibilities; he knew also the opposition to be encountered and how to overcome it. Straightforwardness was one of his greatest assets. He was quick in thought and was fearless in expressing himself when contending for what he believed the best interests of the industry and his company. Mr. McCall was in every sense a great man, with a lovable and winning personality. When sickness overtook him and he felt that he could no longer shoulder the burdens, it fell to my lot to relieve him of the load. For four years I have tried to do as he would have done had he been in possession of his health. As the industry well knows, these have been four troublous years, but we have come through them with honor and flying colors, and I am sure that no one was more pleased with our performance than J. B. McCall. He gloried with us in placing the Philadelphia Electric Company in the front rank of the public utility companies of the world, and it is in a measure consoling that he was spared long enough to realize that he left behind him a wonderful monument and an organization capable of carrying on the work and adding prestige to the institution he founded."

Committee Reports Shoals Resolution

Following Request from President, Amendments Are Rejected, Despite Senator Norris' Opposition—Colonel Cooper Decries Plans for Nitrate Manufacture

BY PAUL WOOTON
Washington Correspondent of the ELECTRICAL WORLD

THIRTY minutes before the agricultural committee of the Senate was scheduled to begin its final session for the consideration of the House Muscle Shoals resolution on Wednesday, members of the committee, in response to a request from the President, assembled at the White House and were urged by the Chief Executive to report out the concurrent resolution without amendment. He explained that he thought the matter should be settled and that the resolution as passed by the House seemed to be the most promising method of obtaining results.

The President was told very frankly by some of his callers that they feared the phraseology of the House resolution would result in confining bids to those mainly interested in the manufacture of nitrates and not particularly concerned in distributing the power not so employed. Mr. Coolidge was not convinced, however.

When the committee reassembled the various amendments proposed were defeated and by eleven votes to five the bill was reported in accord with the President's wishes. The amendments, however, will be presented again on the floor of the Senate. The principal changes proposed were the elimination of the reference to the Ford offer, provision for the distribution of all power not needed for fertilizer purposes "within the full radius of economic use," and provision for the distribution of the excess power under the conditions of the water-power act.

Senator Norris commented as follows on the President's action: "This action by the committee is about as bad as the Ford proposition, except that it proposes 50 years instead of 100 years. I think it fair to say that the committee would not have taken the action if let alone. I don't expect the resolution to be accepted by the Senate. Its viciousness will be and is now being recognized by the people of all the Southern States."

Development of the Tennessee River as a whole by private capital, so as to provide maximum storage, was advocated in a statement submitted to the committee by Col. Hugh L. Cooper. The invitation calling for bids should, he contends, contain stipulations that the development of the whole river shall be by private capital, the government to bear only the expense of purely navigation features; that leases shall be under the federal water-power law for a fifty-year term, together with strict regulation by the states concerned, all power from the Muscle Shoals Dam to be subject to prior use for national defense and fertilizer manufacture, and that the lessee board of directors shall contain three nominees of the United States government.

After dwelling on the need of the South for cheap power, Colonel Cooper said: "Regarding the manufacture of fertilizer at Muscle Shoals, it is now known that water power plays only a minor part in what are considered today the most successful processes for producing nitric acid. It is similarly well known and admitted in all intelligent circles that chemistry as applied to fertilizer is in a transitory experimental stage, where what is the best today will probably be obsolete tomorrow. To take another leap into a field that is registering new improvements about every six months, by committing public or private money to further vast investments in fertilizer and nitrogen plants, will be, until chemistry is on a firmer ground than it is now, a plan to pile up more monumental folly and get nowhere in so doing."

E. H. Hooker, president Hooker Electrochemical Company, told the committee that Muscle Shoals could develop abundant fertilizer at half the price the farmer now pays.

Power Fight on in New York

Governor Smith Attacks State Board and the Contemplated Grants to Private Interests

INEVITABLE since the purpose of the New York State Water Power Commission to grant to power companies licenses for hydro-electric development on the St. Lawrence and lower Niagara Rivers became known, the fight between the advocates of state development of public water powers and the advocates of their private development on lease under strict regulation began at Albany this week. Governor Smith again reiterated in a message delivered on Monday his policy of a state Water Power Authority and declared for the abolition of the commission, and bills to carry out his recommendations were introduced in both houses by Democratic legislators. The Republican leaders, on the other hand, stood by the commission and defended its policy.

The executive attack was specifically directed against the preliminary permits that the Water Power Commission desires to grant to the Louisville Power Corporation and the St. Lawrence Valley Power Corporation for the Long Sault Rapids site in the St. Lawrence and its favorable attitude toward the Lower Niagara River Power & Water Supply Company, which already holds a permit for a development in the Niagara gorge. Two million horsepower is involved in these applications, and the two companies first named are, it is understood, allied with the aluminum producing interests. Their projects are estimated to involve the enormous expenditure of $250,000,000 or more, while the Niagara project might cost $30,000,000.

Declaring for a clear-cut definition of the state's water-power policy, Governor Smith said:

"Why should any individual or group of individuals get possession of the property of the people of this state when it is possible for the state to develop these water powers under state ownership and under state control? The history of all the grants of water power at Niagara Falls should in itself be sufficient to condemn the policy of giving away for small annual rentals these great properties, which should be preserved for our use and the use of our children. The wasteful policy of the past is emphasized by the report of the commission itself when it says:

" 'The commission in the past year has largely devoted its attention to securing adequate compensation for the use of state-controlled waters from these companies which for years have been using these waters without fully compensating the state for the privileges enjoyed.' "

If the Water Power Commission wins the fight and the developments are, with federal and Canadian consent, carried out on the scale planned, the question of water-power development in New York State will be settled permanently, as the sites in question contain almost all the hydro-electric sources now at the state's disposition.

Governor Smith's stand was vigorously combated in public statements by Senator Knight, Republican leader in the State Senate, and other advocates of private development, who pointed out that the existing law is modeled on the federal water-power act. In rebuttal Mr. Smith, declaring that the people themselves rather than the state government should reap the benefit from public water powers, contended that the cheap rates charged the small consumer by the Ontario Hydro-Electric Power Commission furnished an object lesson by which the legislators and state executives should be influenced.

It is asserted that the commission which, under the leadership of Charles E. Hughes, is now preparing a plan for the reorganization of the state departments will recommend the abolition of the existing Water Power Commission and the substitution of a body some at least of whose members would be appointees of the Governor.

Electrification of the Great Northern Tunnel

In a discussion of the forthcoming electrification of a new Cascade Mountain tangent tunnel with Jackson & Moreland, consulting engineers, Ralph Budd, president of the Great Northern Railway, said in Boston the other day that the new tunnel will be about 7½ miles long and that it is planned to complete the project in three years. The cost of the tunnel will be about $10,000,000, and it will cut off 18 miles of existing grades and curves, permitting a reduction of several hours in the running time of trains. Hydro-electric power from existing plant facilities of the road will be used in train operation. The electrification of about 25 miles of track in connection with the tunnel will call for single-phase transmission and the use of direct-current motors in driving the locomotives.

Operating Engineers Exchange Views

Midwest Power Conference Discusses Water-Power Development and Operation, Rural Service, Interconnection, Powdered-Fuel Combustion and Other Topics

TWENTY timely major topics and several associated ones touching on problems of utility, industrial and consulting engineers were discussed by men of national note before the Midwest Power Conference at Chicago on Jan. 26 to 29 inclusive. The conference was well attended not only by Middle West engineers but by men from other parts of the United States. Exhibits were shown by 250 manufacturers. The program of papers and addresses was printed in the ELECTRICAL WORLD for Dec. 26, page 1324. Comments by Samuel Insull on power developments in the Mississippi Valley, regarded as among the high points of the conference, are printed on page 313.

Daniel W. Mead of Madison, Wis., a consulting engineer, dealing with hydraulic power in the Middle West, alluded to the uncertainties of any broad estimate of available water-power resources and maintained that data adequate for commercial development must be based on detailed studies of markets, transmission and development costs and existing legal restrictions and entanglements.

Changing viewpoints on hydraulic turbine practice were presented by H. Birchard Taylor, of William Cramp & Sons, Philadelphia, who pointed out that many accepted principles of twenty years ago are now considered fallacious and that many principles then neglected are now of controlling importance. The necessity of avoiding high velocities and abrupt changes in water-conduit cross-sections was particularly stressed.

Some valuable suggestions regarding hydraulic plant operation were made by L. F. Harza of Chicago. He emphasized the value of hydro-electric plants for supplementing steam-power service even in the Middle West, where steam is predominant. When the dam and appurtenances have been provided, he held that the strictly power-house cost for heads of 25 ft. or more is less than for steam plants, assuming a capital investment on the latter of $125 per kilowatt.

SERVING THE FARMER

G. C. Neff, chairman of the N. E. L. A. rural electric service committee, pictured what electrification can do for the farmer in higher production, higher income and better living standards. Prof. E. H. Lehman, supplementing Mr. Neff's remarks, told how on experimental farms in Illinois an average of 313 kw.-hr. per month per farm was used in November and more than 280 kw.-hr. per month in the last five months of last year—ten times the usual consumption of farmers. Though less than 4 per cent of the 6,500,000 farmers in the United States now receive central-station service, Mr. Neff said that between the Alleghenies and the Rocky Mountains there are already 100,000 farms receiving this service, which is transmitted over 33,000 miles of rural lines.

Some conception of the valuable data in the report of the superpower committee of the Great Lakes Division of the N. E. L. A. was afforded by R. F. Schuchardt. Of intercity lines in the Great Lakes states and closely surrounding states, there are in actual distance 7,200 miles in Illinois (of which 730 miles are operated at 60,000 or more volts), 6,900 miles in Iowa, 6,200 miles in Ohio, 6,000 miles in Wisconsin (of which 1,500 miles are operated at 60,000 volts or more), 6,000 miles in Minnesota, 5,500 miles in Indiana (of which 55 per cent is operated at more than 60,000 volts) and 4,600 miles in Michigan. In the foregoing states, Missouri and Kentucky 60 per cent of the homes are wired, compared with 50 per cent for the entire United States. Electric power development in the Chicago district was traced since its inception by W. S. Monroe of Sargent & Lundy.

Powdered-fuel combustion was dis-

cussed by C. F. Hirshfeld of the Detroit Edison Company, who called attention to the indicated supremacy of unit coal-preparation plants or direct firing, the increased advantage of powdered-fuel firing as the coal becomes of poorer quality, the flexibility of powdered-fuel firing as regards slight variations in the quality of coal burned and its efficiency with large changes in rating, the necessity of not depending on stacks for ash disposal, and the mistake in assuming that only the poorer grades of fuel will be burned because powdered-fuel furnaces permit their use.

Mr. Hirshfeld looked for an increase in the use of powdered fuel, but at the same time maintained that the stoker is not doomed. Greater agitation of fuel and air will, he thought, reduce the size of furnaces and consequently the cost. Unit mills are expected to take precedence.

E. H. Tenney presented a progress report on experience with unit pulverizers at the Ashley station, St. Louis, which has tried semi-turbulent agitation of fuel and air, the furnaces having 5.75 cu.ft. of volume per boiler-horsepower. Eighty per cent of the total air is introduced with the fuel, and water-cooled refractory-faced blocks are employed to protect the furnace walls. Fifteen kilowatt-hours per ton is required to operate the coal-preparation equipment.

Henry Kreisinger explained the reasons for using large furnaces in the past, admitting that with water-cooled walls and more violent agitation of fuel and air furnaces can be reduced in size. Regarding the centralized coal-preparation plant as opposed to direct firing, he questioned whether any operating company using large boilers will eventually wish to rely on unit coal-preparation equipment without reserve. He held that the direct-firing method has advantages with small boilers, but believed that the pendulum will swing back to the central system.

The possibility of greatly reducing the fuel costs of power plants or even eliminating them entirely through low-temperature carbonization of coal, sale of the by-products and burning of the remaining powdered semi-coke was discussed in considerable detail by H. W. Brooks of the Fuller Lehigh Company.

Taylor Praises Plant Efficiency at Muscle Shoals

In the course of testimony before the appropriations committee of the House, General Harry Taylor, the Chief of Engineers, referring to the dam and power plant at Muscle Shoals, said:

"We started one of the generators with a load on Sept. 12 and began to build the load up about 10 o'clock in the forenoon, and by noon it was built up to 24,000 kw. It ran full load for a month without the slightest hitch, and we have not had a hitch yet. I think that is something that has seldom if ever before occurred in any plant of that size in the country. The other generators have gone exactly the same way. There is not a thing down there that we have discovered yet that gives us the slightest trouble. We know that there is no water going through the dam or underneath, because during the summer, when the river was down, the north channel was practically dry. No water came by that end of the dam. We examined the riverbed all down below the dam, all over the bed of the river for half a mile below, and there was not the slightest indication of water getting by anywhere. At the south abutment there are about two cubic feet per second going by around the end of the dam. We know where it comes from and the reason why it is going by, but it is not worth while to stop it."

Western Inspectors' Plans

They Aim to Follow Uniform Practices, Assume Broader Responsibility and Co-operate Better

SOLUTION of the problem of fuse abuse was an outstanding topic at the twenty-first annual meeting of the Western Association of Electrical Inspectors, held in Chicago last week. One entire session was devoted to a symposium on this subject to which William P. Briggs, Joseph C. Langdell, H. J. L. Frank, Karl Bausman, A. Penn Denton and Howard M. Maxwell made contributions, representing respectively the engineer, the central station, the manufacturer, the central station (educational), the electrical contractor and the electrical inspector. (See program in ELECTRICAL WORLD for Dec. 26, page 1324.)

Nearly all of the speakers agreed that the solution lay, first, in successfully conveying to the public that the fuse is the safety valve of the electrical installation and, second, in a specially designed branch-circuit fuse, in conjunction with the sealing of the service fuses, the convenient location of branch-circuit fuses and the free servicing of fuses by the lighting company, together with a firm stand on the part of the municipality to discourage fuse tampering.

Conspicuous emphasis was given throughout the meeting to the need for a broader responsibility on the part of electrical inspectors. Various speakers urged upon the inspectors a more intelligent enforcement of the National Electrical Code. It was held that better co-operation among inspectors in preserving the code would be brought about by refraining from the adoption of special rules, by a more comprehensive dissemination of information concerning their work to architects as well as to all members of the electrical industry in their own communities, by giving the public wiring that would more nearly meet its requirements, by more intelligent advice to consumers concerning efficient lighting and by the protection of the public against the sale of illegitimate material and fittings.

This point of view was effectively focused in the last session of the convention by Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD, who spoke on "What the Electrical Industry Thinks of the Inspector" and made definite recommendations for a broader service by the inspector. His address is published on page 329.

Others on the program for addresses on various phases of the association's work were S. B. Williams, editor *Electragist;* A. R. Small, W. J. Canada, Harry B. Kirkland, J. V. Van Buskirk, W. L. Goodwin, J. A. Hoeveler, Israel Lovett, Dr. M. G. Lloyd and J. C. Cain.

The concluding action of the convention was the adoption of a constitution establishing this group as the Western Section of the International Association of Electrical Inspectors, the purpose being to go forward with plans that it is hoped will eventually bring about the combination of the various sectional associations of electrical inspectors into an organization embracing all America, including Canada, and through this action gradually achieve uniformity of inspection.

Officers elected were: President, James S. Mahan, Chicago; first vice-president, John W. Kelly, Jr., Camden, N. J.; second vice-president, Harley R. Markel, Columbus, Ohio; secretary and treasurer, William S. Boyd, Chicago. The executive committee, in addition to the officers, will include L. A. Barley (chairman), Denver; William P. Briggs, New Bedford, Mass.; Morgan P. Ellis, Chicago, and William A. Haig, Milwaukee. The next meeting will be held in Kansas City in January, 1927.

Licenses and Permits Granted by Federal Commission

A license has been authorized by the Federal Power Commission covering the construction of the Pit No. 4 plant of the Shasta Power Corporation of San Francisco. The license is in pursuance of a preliminary permit issued May 23, 1923. Pit No. 4 unit is to be constructed down stream from the Pit No. 3 unit, already under license. The No. 4 plant will contain an installation of 100,000 kva. The primary power available at the site is 62,000 hp.

A license also was authorized for Walter Cravens of Kansas City, covering a project on the Osage River in central Missouri. The primary power available at the site covered by this license is 18,000 hp., but an installation of 125,000 kva. is planned.

A preliminary permit was authorized for the Kentucky Hydro-Electric Company of Louisville covering a 10,000-hp. project on the South Fork of the Kentucky River. It is proposed to erect a 160-ft. dam near Booneville, Ky., which will regulate the South Fork and add to the primary power at the government dams below. The plan is to construct power houses at six of these dams, where the available head varies from 17 ft. to 19 ft.

A preliminary permit covering a 25,000-hp. development near Airdale on the North Fork of the Kentucky River was granted to Offutt, Loughridge, Gunn & Hiffner of Lexington.

A preliminary permit for the Kentucky-Tennessee Light & Power Company of Bowling Green, Ky., was authorized. It covers a power project at government dams No. 1, No. 2 and No. 3 in the Green River. The power capacities and the proposed installed capacities of the sites are 800 hp. and 6,000 hp. respectively for Dam No. 1, 560 hp. and 4,200 hp. for Dam. No. 2, and 520 hp. and 4,200 hp. for Dam No. 3.

Purchases and Mergers

Insulls Take Over Terre Haute Plant—Eleven States Represented in List for Week

ANNOUNCEMENT is made that the Insull interests have obtained control of the Terre Haute, Indianapolis & Eastern Traction Company, one of the most important interurban railway lines in Indiana, and that it will be merged, with the Central Indiana Power Company, into the Indiana Electric Corporation. The Terre Haute, Indianapolis & Eastern leases the Terre Haute Traction & Light Company, which is known as its Terre Haute division and which serves with light and power Terre Haute, Brazil and other places in Indiana, as well as Vermilion, Ill.

At a reorganization meeting in Chicago last week the various subsidiaries of the Western United Gas & Electric Company, serving Aurora, Elgin, Murphysboro and other Illinois communities, were grouped under the controlling company, of which the Western United Corporation holds all the outstanding common stock. Col. Ira C. Copley will continue as president of both the companies named. E. H. Rollins & Son and A. E. Fitkin of New York have taken substantial blocks of the new stock, and the properties will be operated by the General Engineering & Management Corporation, the Fitkin operating organization.

Approval of the merger of the Newburyport Gas & Electric Company into the Haverhill Electric Company has been granted by the Massachusetts Department of Public Utilities, both companies being under the management of Charles H. Tenney & Company, Boston. As previously stated in the ELECTRICAL WORLD, a tie line will be built between the two systems and marked economies in operation gained by interconnection. To effect the consolidation the Haverhill company will issue 26,932 shares of new capital stock at $25 par value, such shares to be issued to the Newburyport stockholders on the basis of seven shares of Haverhill stock for ten of Newburyport.

Consent has been given by the New York Public Service Commission to the Hammondsport Electric Light Company to sell its property to the New York Central Electric Corporation for the sum of $59,000.

An extension of the Pennsylvania-New Jersey system of the General Gas & Electric Corporation in southern Pennsylvania has been made by the acquisition of the Orrtanna Electric Light & Power Company, which serves a section of Adams County. The company is supplied with power by the Gettysburg Electric Company.

Stockholders of the Iron Mountain (Mich.) Electric Light & Power Company have voted to dispose of its properties to the North American Company. The Iron Mountain company purchases its power from the Peninsular Power Company, which was recently made a part of the North American system.

Colonel Ira Vaughn of Philadelphia, and associates, who own and operate the Southside Virginia Power Company, have purchased the plant of the Luray Power Company at Luray, Va., which has become a unit in the chain of electric plants controlled by the Vaughn interests.

The Texas Utilities Company of Plainview has purchased the electric light and power plants of the Lamb County Utilities Company at Sudan and Amherst and has obtained a franchise for a plant at Muleshoe.

The Home Light & Ice Company of Pittsburg, Tex., has been purchased by the East Texas Public Service Company of Marshall. The acquired plant supplies Pittsburg, Newson and Leesberg.

The city authorities of Harrodsburg, Ky., are considering offers for purchase of the city's electric light plant. The Kentucky-Tennessee Light & Power Company has made an offer, reported to be $100,000, and the Kentucky Utilities Company has also been negotiating for the plant.

The Tell City (Ky.) Light & Water Company, municipally owned, has been sold to the Kentucky-Tennessee Light & Power Company, a subsidiary of the Associated Gas & Electric Company of New York. Its bid was $231,250.

W. A. Koster, president of the Modern Light & Power Company, Atkins, Iowa, has sold his plant and transmission lines to the Iowa Railway & Light Company for $35,000.

The Tri-State Utilities Company of Minneapolis has bought the C. F. Boyes electric plant at Osmund, Neb.

New Jersey Public Service to Build Five Substations

New construction items for the Public Service Electric & Gas Company of New Jersey include $6,411,000 to be spent on substations, $3,285,000 to be spent in extending and strengthening transmission lines and $2,928,000 in the betterment of the distribution system. Of the appropriations for substations, more than $2,000,000 will be spent for new units, $1,500,000 for additions to existing units and $2,750,000 for changing stations over from two-phase to three-phase operation, thus doubling their capacity.

New substations are to be built in Carteret, Jersey City, Bayonne, Paterson and Monmouth Junction. More than $1,000,000 is to be spent in extending the underground distribution service and some $700,000 in reinforcing distribution circuits, while $300,000 will go for the purchase of spare and emergency apparatus to insure against possible interruptions to service. Provision is also made for replacing arc with type "C" incandescent lamps in the street-lighting systems of both Paterson and Jersey City. This will remove the last of the arc lamps from street-lighting circuits supplied by the company.

M. J. Insull Has Comprehensive Texan Program

Following a trip of inspection of his company's various electrical properties in south Texas, Martin J. Insull of Chicago, head of the Middle West Utilities Company, holding company for the Texas Central Power and the Central & Southwest Texas Utilities companies, has announced plans for an expansion program which will involve the expenditure of a large sum of money during the next four or five years. One of the most notable features of these proposed improvements

Men of Mark in the Electrical Industry Get Together

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ABOVE are shown some of the many prominent electrical men who assembled in New York last week for a notable luncheon under the joint auspices of the New York Electrical League and the Electrical Board of Trade of New York. The men in the picture, who, with O. D. Young, chairman of the General Electric board, were at the speakers' table, are:

Standing, left to right—H. M. Edwards, vice-president New York Edison Company; Philip Torchio, vice-president New York Edison Company; Charles L. Eidlitz, chairman of directors of Electrical Board of Trade; Albert L. Salt, president Graybar Electric Company; Frank W. Smith, vice-president United Electric Light & Power Company; W. J. Drury, general manager Western Electric Company; M. H. Aylesworth, managing director N. E. L. A.; James M. Wakeman, former manager Society for Electrical Development; Albert Goldman, commissioner of plants and structures, New York City.

Sitting, left to right—E. M. Herr, president Westinghouse Electric & Manufacturing Company; Thomas E. Murray, vice-president New York Edison Company; Charles G. Du Bois, president Western Electric Company; Arthur Williams, vice-president New York Edison Company (chairman); George B. Cortelyou, president Consolidated Gas Company; John W. Lieb, vice-president New York Edison Company; J. E. Davidson, president N. E. L. A.

is the invasion of northeastern Mexico with a power transmission system that may extend to Monterey, Victoria, Tampico and other cities. The plant which will supply this electrical energy will be erected at some point in the lower valley of the Rio Grande, close to the international boundary stream, in order that an abundant supply of water may be available. The transmission system will, it is asserted, also include all of the towns on the American side of the delta of the Rio Grande.

It was definitely decided during Mr. Insull's visit that the electric light and power plant at Three Rivers, Tex., which was purchased by the Central & Southwest Texas Utilities Company, shall be enlarged and made into a "superpower" station. The plant is in the heart of a natural-gas field and that fuel will be used. Another plant is planned in the vicinity of Harlingen, as well as transmission lines covering the entire district from Laredo to Beaumont.

Georgia's Rapid Electrical Development

Summary of Progress in 1925 and Résumé of What Has Been Achieved Since First Hydro Plant Went Into Service in 1896—Prospects for Present Year

THE close of 1925 found Georgia with 279,500 hydro-electric horsepower either developed or in the process of being developed. This is nearly half of the readily available hydro-electric energy of the state, there being 305,850 hp. capable of being developed under present economic conditions and 218,950 hp. which is susceptible of use but at a great expense. Virtually all of this development has taken place since 1896, when the Athens Railway & Electric Company built its first water-power plant on the Middle Oconee River with an installed capacity of 860 hp. at 2,300 volts.

The Georgia Railway & Power Company put two plants into commission in 1925, the Yonah development and the Terrora development. The Yonah project has a dam 900 ft. long and 75 ft. high, with a development of 37,500 hp. and a generating capacity of 70,000,000 kw.-hr. a year. The Terrora plant will develop 30,000 hp. and has a generating capacity of 63,800,000 kw.-hr. a year. A feature of this plant is a tunnel one mile long cut through solid rock. It has a head of 190 ft. Work was started during the year on the fifth of the Tallulah-Tugalo plants —the Nacoochee project—which will have a head of 60 ft., will develop approximately 7,500 hp. and will have a generating capacity of 20,000,000 kw.-hr. a year. There still remains another plant to be constructed in this series of six—the Burton development, which will have a dam 116 ft. high, a head of 84 ft., a waterwheel capacity of 9,000 hp. and an average annual output of 32,200,000 kw.-hr. When this project is completed, the Georgia Railway & Power Company will have a total generating capacity of 521,000,000 kw.-hr. a year. The company also completed 300 miles of new steel-tower high-tension transmission line in 1925, the longest stretch being 104 miles in length from Toccoa to Augusta, Ga., constructed at a cost of approximately $1,000,000.

Throughout the past year the Columbus Electric & Power Company worked on its Bartlett's Ferry development. This plant, which will operate under a head of 120 ft. and will develop 40,000 hp. at the start, will be brought into use soon and will be an important addition to the power forces of the state. At the present time the installed hydro-electric capacity of the company is 72,000 hp., backed up with a steam plant of a present installed capacity of 12,000 hp. At Goat Rock and Bartlett's Ferry there can still be added a total of about 50,000 hp. which will be of a partially secondary nature, and the present steam-plant location will permit the installation of 18,000 more horsepower. The Columbus Electric & Power Company also owns a power site between North Highlands and Goat Rock capable of giving a head of about 70 ft., where it will be possible to install a minimum of 20,000 hp. as a base-load plant. The total investment, including lines, substations and distributing systems, approximates $17,000,000 for the 72,000 hydro-electric and 12,000 steam horsepower installed.

A third important utility is the Central Georgia Power Company, with headquarters at Macon. This furnishes electrical energy for most of the cities and towns in central and south central Georgia and is interconnected with the Georgia Railway & Power Company at Atlanta and the Columbus Electric & Power Company at Manchester, Ga. It owns and operates at Lloyd's Shoals, near Jackson, a 33,000-hp. hydro-electric plant. The company also owns several important power sites on the Flint and Oconee Rivers, which will be developed as soon as a market develops. It is the ultimate purpose of the Central Georgia Power Company so to extend its transmission system that all of central and south Georgia may be included. New lines are now being built to Borden and McIntyre, in the "clay belts" southeast of Macon, and other extensions will be made as soon as the demand comes for them.

The hydro-electric resources of the Athens Railway & Electric Company include three stations rated at 860 hp., 1,200 hp. and 3,750 hp. respectively. In addition the company has a steam auxiliary plant with a capacity of 4,680 hp. These plants represent a value of about $800,000, and the output of the hydro-electric plants averages 17,000,000 kw.-hr. per annum.

The Augusta-Aiken Railway & Electric Company develops 1,800 hp. from the Augusta Canal and 24,000 hp. from a site on the Savannah River near Augusta. The latter development cost approximately $3,000,000. Other small hydro-electric and steam power plants scattered over the state, some privately and others municipally owned, add materially to the power resources of Georgia.

With the two power projects recently noted in the ELECTRICAL WORLD as under contemplation—one on the Savannah River, in northeast Georgia, and the other in the Okefenokee Swamp—it looks as though the development of 1925 would be continued and possibly exceeded in 1926. Indications, in fact, are that more money will be spent on electric projects during the coming year in Georgia than ever before in any one year. The Savannah River project, fathered by the Twin Cities Power Company of South Carolina and Georgia, which would be about 30 miles up-stream from Augusta and 2 miles east of Modoc, S. C., will rank as one of the most important in the state.

Premier Taschereau, the Carillon Project and Montreal

Premier Taschereau of Quebec, in giving notice in the Legislature on Jan. 29 of his bill in regard to the exportation of hydro-electric power from that province, referred to the Carillon scheme as follows:

"If those interested in the development of hydro-electric power at Carillon will agree to develop and keep this energy within the Dominion of Canada, they are welcome to go ahead with it and we shall be very glad to co-operate with them. The bill of which I have just given notice deals more particularly with the export of power, and we will not give consent to any development unless they agree not to export power to a foreign country. It is generally known that the government is against the export of power to foreign countries, and the object of this legislation is to have it in the law so that there can be no question about the matter."

If the Carillon development is carried out, the promoters will have to seek a market for the surplus over that which it is proposed to export to Ontario. In this connection a controversy is likely to arise, because it is difficult for any outside company to get into the city of Montreal or the suburbs, agreements that have been made for terms of years blocking the way.

Development of another 50,000 hp. of electricity for Montreal is foreshadowed by a bill introduced on behalf of the Montreal Island Power Company, which proposes to develop a water-power site in the Rivière des Prairies and to construct a dam stretching from Cedars Island to a point on the north shore.

International Paper Company Plans Canadian Plants

A second water power on the Gatineau River in the Province of Quebec is to be developed shortly by the International Paper Company. The new hydro-electric plant will be situated at Farm Point, about 40 miles from Ottawa, Ontario, and will supply a portion of the power for the company's new paper mill at West Templeton, a few miles from Ottawa, on the Ottawa River. Power will also be provided from a plant now being constructed at Chelsea, Quebec. It is expected that the two plants will produce at least 150,000 hp.

Municipal Plants in Kansas

State Where They Once Flourished Is Losing Them at Rate of One a Month

KANSAS, long known to the electrical industry as possessing more municipally owned plants in proportion to population than any other state in the Union, is fast losing that reputation. Within the five-year period ended Dec. 31, 1925, fifty-seven municipalities formerly served from city-owned plants determined to avail themselves of electric light and power supplied by privately owned companies. The Information Bureau of Kansas Public Service Companies, to whose just-completed survey the ascertainment of these figures is due, holds that the inadequacy of municipally owned plants to meet increasing demands for power, their high rates and the frequent disruption of service were responsible in most instances for the changes. Not infrequently towns finding themselves with antiquated facilities and facing the necessity of rehabilitating their plants chose the alternative of accepting service from company-owned transmission lines. In not a few instances the municipalities assumed the expense of building a line out to the company's transmission wires. In some cases the towns made the power company a present of the municipal plant and distribution system.

In 1923 alone seven towns in southeastern Kansas gave to a single company their electric distributing systems, a 35-year franchise and, with one exception, a cash bonus in order to induce the company to serve them. The bonuses ranged from $1,000 to $10,000. Many of the towns in question were receiving only twelve-hour or eighteen-hour service under municipal operation.

The trend from municipal to private service, now progressing at a rate of approximately one town per month, is being accelerated by the recent completion in Kansas of two of the largest generating stations in the region between the Mississippi and the Pacific Coast—the Neosho plant of the Kansas Gas & Electric Company near Parsons and the Tecumseh plant of the Kansas Power & Light Company near Topeka. Within recent months central-station companies have found it necessary to decline proposals from several municipally served towns because of the uneconomic conditions involved in such a move.

The average rate obtaining under municipal ownership of the plants covered by the survey was 16 cents per kilowatt-hour. The average rate being charged in those towns by companies now serving them is 10 cents per kilowatt-hour, a decrease to the customer of 37½ per cent.

Decay of Municipal Ownership in Michigan

Of 143 communities in Michigan which once served electricity to their people as a municipal activity, 62 so far have changed over to complete service by private enterprise and 13 more have abandoned their generating plants, retaining their local distribution systems. Fifty-nine still generate energy, some of these, however, purchasing it in addition, and a few have never had generating plants but only distribution systems, which they still retain.

The Michigan Public Utility Information Bureau, which has issued this summary of public ownership in its state, adds the following list of communities which have sold their plants within the last twelve months or so: Addison, Allen, Bronson, Brooklyn, Deckerville, Jonesville, Lawrence, Manchester, Marcellus, Reading and Ypsilanti. Corunna has recently turned over operation of its street-lighting system to the Consumers Power Company.

Briefer News

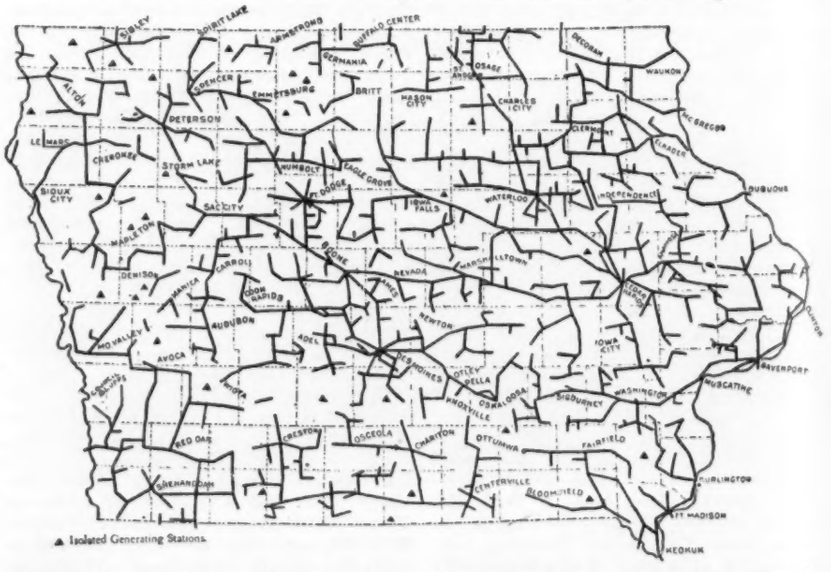
Muscatine (Iowa) Lighting Company Attacks Municipal Plant in Court Proceedings.—A suit has been brought in the district court at Muscatine, Iowa, against the city authorities by the Muscatine Lighting Company in an effort to set aside as illegal the special election authorizing the issuance of bonds for $100,000 to enlarge the municipal electric light and power plant. The city has, however, gone ahead and sold the bonds to a Davenport company.

International Engineering Board Reports Good Foundation Conditions on St. Lawrence.—Good foundation conditions have been found to exist at the three principal rapids on the St. Lawrence, according to the joint engineering board of the United States and Canada, which has now a virtually complete record of the borings. Everything is being done to expedite the report in the hope that it can be completed in April.

Commonwealth Utilities Corporation Organized in Missouri.—Organization of the Commonwealth Utilities Corporation is announced at St. Louis by its president, Wiley F. Corl, formerly president of the Community Power & Light Company. The new company will operate in the Southern field and has already acquired small properties in Louisiana and Mississippi. It is capitalized at $1,000,000, of which about half has been subscribed. An interest in the Community Power & Light Company amounting to about one-third has passed to Stone & Webster. The Community company has holdings amounting to about $20,000,000 in Missouri, Arkansas, Kansas, Texas and New Mexico.

Lighting Salt Lake's Air-Mail Field.—Authority to commence work immediately on the lighting of the Salt Lake City air-mail field, as a part of the lighting system now being installed on the Salt Lake to Rock Springs air route to make night flying possible between these two points, was lately officially granted by the general superintendent. It is expected that this work will be completed within a short time. Included in the lighting plan of the Salt Lake field is one of the largest floodlamps in the country—a 36-in. arc light of 200,000,000 cp., which will be used in giving the "daylight perspective" to the entire field. In addition to

How Iowa Has Forged Ahead Electrically



THE electric light and power business of Iowa has increased nearly 100 per cent within the last three years, this estimated increase being based on the number and rating of generating stations installed within that period. In 1922 the rating of all electric generating plants was 236,680 kw., according to the survey of the Iowa Committee on Public Utility Information, while a survey as of Nov. 12, 1925, puts their capacity at 370,644 kw. This figure does not include the output of the new plant of the Des Moines Electric Light Company, which by June, 1926, will increase the total by 65,000 kw. Iowa has 10,000 miles of transmission lines and 99.5 per cent of its urban communities have electric service, which Iowans claim is the highest percentage in the Union. This high degree of saturation is well shown in the above map.

this there will be a 24-in. incandescent beacon light of 5,000,000 cp. and a number of boundary lights to mark the rim of the field and the byways. The plan also calls for red obstacle lights, which will indicate all objects to be avoided by the pilots in landing.

Hydro-Electric Plant on North River, Wash., Planned.—Application has been filed with the Washington State Supervisor of Hydraulics for permission to build a 10,000-hp. (continuous) hydro-electric plant on the North River at Canto, 8 miles from Raymond and not far from Willapa Harbor. The Willapa Electric Company, which is the applicant, desires to appropriate 5,000 sec.-ft., for which purpose it will build a dam 125 ft. high and submerge 5,540 acres. The plan is to start work in April, 1927, at the latest and to complete the installation by January, 1929.

West Penn Electric's Rating to Go Up 100,000 Kva. This Year.—The completion next spring of the 50,000-kva. turbo-generator now being installed in the Springdale plant of the West Penn Electric Company, near Pittsburgh, and the inauguration later in the year of the first unit of the Cheat River hydro-electric development, with about equivalent capacity, will increase by 100,000 kva. the rating of this company, into which are now consolidated all the electric subsidiaries of the American Waterworks & Electric Company.

California Edison Has New Plan for Joint Use of Poles.—Having as its object the increased use of joint poles by the utilities, an agreement has been entered into by the Southern California Edison Company and thirty southern California telephone companies whereby the Edison company will rent to the telephone companies the right to use a pole rather than sell a half interest in the pole as has been done heretofore. It is thought that this new system will not only increase the joint use of poles but will also result in large savings in the cost of extensions.

Osage Project Finally Approved by Missouri Commission.—Final approval has been given by the Missouri Public Service Commission to the nineteen-million-dollar hydro-electric dam and power plant to be built on the Osage River near Bagnell, Mo., by the Missouri Hydro-Electric Power Company of Kansas City. The commission, which, as already reported, had granted a conditional certificate to the company, had held up the final award pending the consent of Camden, Benton, Miller and Morgan Counties to the project. All of these counties will be affected by the dam and the 110-mile lake it will create.

A "World's Record" Cable.—The two 10,000-hp., 23,400-ft. cables which, as already announced, the Puget Sound Power & Light Company is soon to string across Puget Sound between Edmonds Point, on the mainland, and President's Point, on the Olympic peninsula, will weigh about 15½ lb. a foot, or nearly 750,000 lb. in all. Taking into consideration length, power voltage and depth of water—in places more than 125 fathoms—the installation is said to form a new world's record in submarine transmission. The cable will be delivered in lengths of 2,700 ft., and there will be seven splices in each completed span. All these will be made ashore and each span lowered by means of a power hoist. The cable will be delivered about May 1.

Calumet Gas & Electric Asks Change of Name.—A change of the name of the Calumet Gas & Electric Company to Northern Indiana Public Service Company is asked as part of an amendment to the charter of the company. The Calumet Gas & Electric Company, which is one of the operating subsidiaries of the Midland Utilities Company, two years ago served Crown Point and Lowell and a few rural communities and supplied electrical energy for the operation of the Gary Railway system. By the purchase of other properties extending across northern Indiana from the Illinois to the Ohio state line, the company has extended its service to 83 communities, and the new name will more accurately describe its territory.

Ontario Has 3,428,000 Hp. in Minimum-Flow Water Power.—According to a booklet recently issued by the Ontario government, the estimated water-power capacity available in the province (at 80 per cent efficiency) at ordinary minimum flow is 3,428,152 hp. and at ordinary six months flow 4,825,142 hp. There were on January 1, 1925, installed hydro-electric plants capable of producing 1,585,333 hp. The totals of available powers utilized in the calculation included, however, so far as the Niagara River is concerned, only an amount of power which is equivalent to the diversion of water power by the Canadian-United States treaties. The total potential power possibilities of the Niagara would raise the provisional totals to some 5,330,000 hp. at ordinary minimum flow and 6,940,000 hp. at ordinary six months' flow.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

American Institute of Electrical Engineers — Midwinter meeting, New York, Feb. 8-11; regional meetings: Cleveland, March 18-19; Madison Wis., May 6-7, and Niagara Falls, N. Y., May 26-28. F. L. Hutchinson, 33 West 39th St., New York.

Eastern Association of Electrical Inspectors—Hartford, Conn., Feb. 10. E. P. Slack, 123 William Street, New York.

New Mexico Electrical Association—Franciscan Hotel, Albuquerque, Feb. 15-17. B. L. Wiles, Albuquerque.

Oklahoma Utilities Association—Mayo Hotel, Tulsa, March 9-11. E. F. McKay, Local Bldg., Oklahoma City.

Illinois State Electric Association—St. Nicholas Hotel, Springfield, March 17-18. R. V. Prather, 205 Mine Workers' Bldg., Springfield, Ill.

Middle West Division (and Iowa Section), N. E. L. A.—Fort Des Moines Hotel, Des Moines, April 8-10. H. M. Davis, Fraternity Bldg., Lincoln, Neb.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

Southeastern Division, N. E. L. A.—Pinehurst, N. C., April 27-29. E. T. O'Connell, Alabama Power Co., Birmingham.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, Keith Bldg., Cleveland.

Alleged Defective Wiring in Virginia's Capitol. — Public concern has been aroused in Virginia over a report made by the chief city electrical inspector of Richmond that the historic State Capitol and the Governor's mansion, in the latter of which a bad fire recently occurred, are firetraps owing to the promiscuous way in which electric wiring has been installed and the absence of proper inspection. The recent fire—caused by an ignited Christmas tree—led the Governor to call in the city inspectors, who have no official jurisdiction over state buildings. A modern installation is likely to take the place of the existing one, part of which is thirty years old.

Philadelphia Engineers to Discuss Conservation of Power.—A conference on the conservation of power in industrial plants will be held at the Engineers' Club of Philadelphia on Feb. 16, with morning, afternoon and evening sessions. Erb N. Dittenhofer, engineer with the Gotham Industrial Corporation, will read a paper on "Economy Due to Power-Factor Correction," and Francis Hodgkinson, chief engineer of the Westinghouse company, one on "High-Pressure Prime Movers in Industrial Plants." Other engineers who will present papers are William Staniar of Wilmington, Del.; John D. Gill of Philadelphia, Ward Harrison of Cleveland, Samuel M. Greene of Springfield, Mass.; L. B. McMillan of New York, R. H. Heilman of Pittsburgh, David M. Myers, Thomas V. Balch and Reginald P. Bolton, all of New York.

Richmond-Fredericksburg Transmission Line Authorized.—Work is to begin at the earliest possible date on a 66,000-volt, 60-mile transmission line between Richmond and Fredericksburg, Va., to cost $750,000, according to an announcement by William E. Wood, vice-president Virginia Electric & Power Company. If negotiations now under way to link up Kinston, Elizabeth City and Wilson in northeastern North Carolina with the company's system are successful, these towns will be interconnected with the company's system at an expense of $2,000,000, and a continuous transmission line will extend from northern Virginia to the Southern Power Company's territory in North Carolina. The company's proposals, however, have been unfavorably received by the authorities of Wilson, which, like the two other cities named, is served by a municipal plant. Kinston and Elizabeth City have not yet, so far as known, made response.

Men of the Industry

Thomas A. Edison left Tuesday night for his winter home in Fort Myers, Fla., where he will celebrate his seventy-ninth birthday on Feb. 11.

Arthur Williams, vice-president of the New York Edison Company, has been awarded the medal of the Legion of Honor for his work in behalf of the Home Appliance Exposition at Paris. Mr. Williams was previously decorated by the French government when he was made an Officier de l'Instruction Publique.

George E. Learnard, president of the International Combustion Engineering Corporation, sailed for Europe Saturday, Jan. 30, to make a survey of the company's European business.

Thomas Sproule, assistant general superintendent of distribution of the electric department of the Public Service Electric & Gas Company, Newark, N. J., has been appointed general superintendent to succeed W. K. Vanderpoel, whose resignation was announced in the Jan. 23 issue of the ELECTRICAL WORLD. Mr. Sproule has been associated with the Public Service company since 1921.

Paul B. Simons, formerly vice-president and general manager of the Michigan Gas & Electric Company of Three Rivers, Mich., has joined the engineering department of the Delta-Star Electric Company of Chicago. Mr. Simons' long experience in the management and operation of public utilities will enable him to carry the viewpoint of the operator into the Delta-Star organization.

E. W. Lloyd, who has recently been appointed vice-president of the Commonwealth Edison Company in charge of sales of electricity for light and power, as already announced in the ELECTRICAL WORLD, was the guest of honor at a dinner given to him by his friends at the Palmer House, Chicago, Feb. 1. Mr. Lloyd has been a figure of national prominence through his many years' association with the Commonwealth Edison Company and his active interest in the affairs of the National Electric Light Association. He is a past-president of that society and is at the present time serving as chairman of the Commercial Section.

W. C. Campbell, formerly assistant to B. C. Edgar, new president of the Tennessee Electric Power Company and the Nashville Railway & Light Company, has been placed in charge of all operations in the communities served outside of Chattanooga and Nashville. This position is a new one and is the result of the continual expansion of the company's business throughout middle and eastern Tennessee. Mr. Campbell has been associated with various branches of the public utility business for the past 25 years. Early in his career he entered the test department of the General Electric Company at Schenectady and later served that company in New York, going from there to the Pacific Coast to engage in construction, engineering and sales work. In 1914 he severed his connection with the General Electric Company to become assistant general superintendent of the Columbus (Ohio) Railway, Power & Light Company, being promoted to general superintendent in 1918. One year later Mr. Campbell went to Chattanooga as assistant to B. C. Edgar, then vice-president and general manager.

H. T. Sands to Join Electric Bond & Share

Howard T. Sands, vice-president of Charles H. Tenney & Company, Boston, and president of the Haverhill Electric Company and Montpelier & Barre Light & Power Company, has resigned, effective March 1, to join the organization of the Electric Bond & Share Company, with headquarters in New York City. Mr. Sands is one of the best known and

H. T. SANDS

most highly regarded executives in the public utility field, and his work in public relations has been exceedingly valuable to the industry for many years. He is a vice-president of the National Electric Light Association, a past-president of the New England Division and a past-chairman of the Public Relations National Section. Biographical appreciations of Mr. Sands' career were published in the ELECTRICAL WORLD for Oct. 14, 1922, and June 30, 1923.

A. H. Grimsley has been elected president of the Virginia-Western Power Company, Clifton Forge, Va., to succeed A. C. Ford, resigned. Mr. Grimsley will continue as general manager, the office he occupied before his election to the presidency.

K. H. Smith of Halifax has resigned as chief engineer of the Nova Scotia Power Commission, with which he has been connected since its inception. Mr. Smith's future plans are not sufficiently matured to warrant any statement at the present time. Harold S. Johnston has been appointed chief engineer to succeed Mr. Smith, with whom he has been associated since 1920 as hydraulic engineer. Mr. Johnston has been intimately associated with the development of the commission and is responsible for the design and structure of the 5,550-hp. and 6,580-hp. Malay and Ruth Falls developments of the Sheet Harbor system and other hydro-electric developments. Mr. Johnston will be assisted by **J. F. Lumsden** of Halifax, formerly electrical engineer, who has been appointed assistant chief engineer.

Obituary

Carter Miller, advertising manager of the Timken Roller Bearing Company, died Jan. 11 after a brief illness. Mr. Miller joined the Timken Company six years ago and was promoted rapidly to various positions both in the field with the Timken Roller Bearing Service & Sales Company and at the home office with the Timken Roller Bearing Company. Later he was given charge of the advertising department, which position he held until the time of his death. He was a native of Bay City, Mich.

Frederick A. Huntress, one of the best-known public utility men on the South American continent and vice-president and general manager of the Brazilian Traction, Light & Power Company, controlling the electric light and power, street-railway, gas and telephone service of Rio de Janeiro and São Paulo, died at Boston Jan. 27. Mr. Huntress was a pioneer electric railway executive and in earlier years was active in the traction field at Boston, Worcester, Montreal and Halifax. He went to Rio in 1905.

Arthur R. Bush, manager of the industrial department of the General Electric Company, died at his home in Schenectady on Jan. 24. Mr. Bush entered the employ of the Edison Company for Isolated Lighting in 1884, following which connection he was identified with the New England Wiring & Construction Company. In 1892 he was made district engineer of the Edison General Electric Company in the New England district, resigning this position in 1904 to accept the vice-presidency of the Union Bag & Paper Company. He remained with this concern until 1906, when he returned to the General Electric Company, where he became manager of the power and mining department and later manager of the industrial department.

John M. Munro, Scottish consulting engineer, died Dec. 29 in his seventy-third year. Mr. Munro's early efforts were in the field of telegraphy and telephony, but later he developed an interest in lighting and became an authority of some note on illumination. The firm of Anderson & Munro, founded by his father, Donald Munro, installed a lamp in front of the Glasgow *Herald* building in 1881—the first application of electricity to street lighting in Glasgow. In 1910 Mr. Munro severed his connection with the firm of Anderson & Munro, and from that time he had acted as a consultant on hydro-electric work and town lighting. He was one of the founders of the Scottish Section of the Institution of Electrical Engineers, the chair of which he occupied in 1905, and he was the joint author with Prof. Andrew Jamieson of a "Pocket Book of Electrical Rules and Tables" which ran through many editions.

Commission Rulings

Poor Service Forfeits Right to Territory.—In Linn, Mo., a place of 700 inhabitants, the Linn Electric Light Company, incorporated in 1909 to supply electricity, had a small old-style plant which gave indifferent service and depended largely on power from a mill. This power was intermittent, and the service, which was under a twenty-year franchise, was unsatisfactory to the consumers. The Missouri Public Service Commission therefore allowed a competing company, the Gasconade Power Company, to enter the territory, stipulating that this company should agree to take over such parts of the Linn company's equipment as could be used in a modern plant, at a price to be fixed by the commission. The commission said: "The testimony shows that the service by Leonard's [the Linn Electric Light] company to its customers is not dependable and that the citizens of Linn do desire and are in need of dependable and efficient lighting service, which it is believed applicants are prepared to furnish. It would be unreasonable to hold that the citizens of Linn should be denied the service to which they are entitled during the remaining nineteen years of the franchise granted Leonard's company merely because of the fact that the better service for twenty-four hours daily offered the citizens of Linn by applicants at a reasonable rate will cause Leonard's company financial loss."

Competition Allowed to Continue When Commission Fails to Get Companies to Agree.—In approving franchises of both the Oswegatchie Light & Power Company and the St. Lawrence Transmission Company to distribute electricity in the town of Gouverneur, N. Y., the New York Public Service Commission, before which the cases had been pending for many months, deploring its failure to bring about an agreement between the two companies, indorsed the finding of one of its members, which said: "The two companies made construction on most of these highways long ago and are now and have been engaged in distributing electricity to consumers thereon. The statutory requirements were ignored until the present franchises were obtained. The franchises granted by the Town Board cover fifteen highways extending from the village of Gouverneur in every direction. On all of these highways except four the Town Board granted franchises to both companies, and in the case of these four the Oswegatchie company has a franchise upon two and the St. Lawrence company upon two. The main transmission lines of both companies are on the highways on which franchises have been granted to both companies. The St. Lawrence company has 33 customers on five of the highways and the Oswegatchie company 54 on ten of the highways. In all instances except one franchises were granted to the St. Lawrence company a few weeks prior to the granting of the franchises to the Oswegatchie company. It was stipulated [conceded?] upon the hearings that both companies have abundance of power and that consumers are getting the same quality of service from each company. It was also conceded that there is not sufficient business in the town of Gouverneur for two companies. The Oswegatchie company serves more customers in the village than the St. Lawrence company. . . . This case presents a good illustration of competition in the business of furnishing electricity. There is almost a complete duplication of plant in this small field. The only thing agreed upon is the rate. It is difficult to fairly allot these highways between the companies. . . . Approval of the commission of all franchises should be given. This in reality does not extend the competition as it already exists, but will legalize the construction and operation."

Recent Court Decisions

Modification of Contract for Electrical Energy Not Binding When Not Filed with Commission.—The Sierra & San Francisco Power Company brought suit against the Universal Gas & Electric Company for an alleged balance of $13,359 for electrical energy furnished, the plaintiff being a wholesaler and the defendant a retailer of service. The defendant claimed that a modification of the contract had been agreed to. This modification, however, had not been properly filed with the California Railroad Commission, in compliance with the law, and therefore the Supreme Court of California sustained the trial court in finding that the selling company could revert to the legal rate without asking the commission's sanction. This was not allowing the plaintiff company to take advantage of its own wrong, since the defendant had concurred in the arrangement which violated the statute and since it could itself have filed the modified contract. (241 Pac. 76.)*

Patentee Must Join Licensee Using Patent in Suit for Infringement.—A licensee may compel the owner of a patent to join in a suit alleging infringement, either in law or in equity, the United States Supreme Court declares in a decision affirming that of the lower court in Radio Corporation of America vs. Independent Wireless Telephone Company. The Radio Corporation secured an exclusive license from the De Forest Radio Telegraph & Telephone Company for the use of a radio communication patent in messages sent from shore to ship for pay. The Independent company purchased tubes from a licensee authorized to handle them for amateur and experimental purposes. The Radio Corporation filed a suit in equity against the Independent company, alleging it was using the tubes in sending messages from shore to ship for pay. The De Forest company declined to participate in the suit as a co-plaintiff and because it was in another jurisdiction it could not be named as a co-defendant. The Radio Corporation thereupon used the name of the De Forest company as a co-plaintiff without its consent. The District Court for Southern New York held that such use of the name of the De Forest company was not legal. The Circuit Court of Appeals reversed this decision and the latter decision is now upheld by the Supreme Court.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Taxation of Engineers Working for State Without Definite Office.—Consulting engineers who perform services for a state or one of its subdivisions without a definite term or an oath of office and who are free to undertake other employment simultaneously are not ordinarily officers or employees of the state or its subdivision within the meaning of the exemption clause in the federal revenue act, and hence their income from such services is taxable by the United States government. In rendering this decision in a test suit brought by Leonard Metcalf and Harrison P. Eddy, consulting engineers of Boston, the United States Supreme Court made plain, however, that it is difficult to set down an inflexible rule because conditions might vary widely.

Prospective Servant on Premises Is Invitee and Proof of Contributory Negligence Is on Owner.—The administrator of one Perkey, killed by contact with an uninsulated wire in a mine belonging to the Virginia Iron, Coal & Coke Company, sued that company for damages, and their award has been approved by the Supreme Court of Appeals of Virginia, which decrees that the man killed, a prospective employee of the company who was in the mine to go through with the preliminaries of employment, was an invitee who did not know of the risk from the electric wire, and that the burden of proof of contributory negligence was on the defendant and the issue for the jury, such negligence not being disclosed by the plaintiff's evidence or fairly inferable from the circumstances. (130 S. E. 403.)

Funds to Carry Street Railway May Have to Be Furnished by Other Branches of a Utility.—Granting a mandamus at the instance of the town of Rutland to compel the Rutland Railway, Light & Power Company to comply with a commission order requiring it to maintain the highway between its tracks as stipulated in its charter, the Vermont Supreme Court declared that a consolidated gas, electric and railway corporation which has assumed the obligations of the constituent companies is under obligation to pave according to the terms of the original charter of the street railway company, even though the funds to meet such paving have to be furnished by the gas and electric departments. It cannot escape a charter obligation to pave even though its street-railway operations are conducted at a loss and the expense will reduce its income below a fair rate, nor does the abandonment of operation of the street railway absolve it from its obligation to put the highway in the condition required. (129 At. 303.)

Financial and Corporate

Utility Market Irregular

Mixture of Moderate Gains and Losses Obscures Trend of Prices in Power Group

IN MANY respects the market in power and light stocks of late has been behaving much like that for investment stocks of the industrial and railroad list, which is to say that prices remain generally firm but move within narrow limits. Continued ease in money rates has not stimulated unwarranted speculation in the utilities to the extent that it has in other groups, for the reason, perhaps, that marginal purchases of the utilities are more difficult to arrange than those of listed issues. Promise of good business in 1926 holds up the prices of the power and light group, but there is no disposition at the moment to force values forward at a rapid pace.

During the week under review gains and losses both appeared, although it must be recorded that the gains outnumbered the losses. Nowhere were the changes particularly important, however. Middle West Utilities improved its position by three points during the week on the prospect of what will be said about earnings in that company's annual statement, Middle West being one of the utilities, incidentally, that does not issue monthly earnings statements. Columbus Electric & Power improved its position by seven points, Tampa Electric by four points and Mississippi River Power rose five points during the week, although in none of these issues was trading particularly heavy. Activity was resumed in Northern Ohio Power Company's stock, and the price rose again to 25 and better, but it was not revealed whether the buying was for speculative account or for permanent investment. Southern California Edison displayed strength on persistent rumors of a stock split-up.

Losses were sustained by such stocks as American Light & Traction, Commonwealth Power Corporation, Eastern Texas Electric, El Paso Electric and Northern Texas Electric.

New German Financing

The offering of a new issue of external 6½ per cent serial gold coupon notes of the Sachsen-Anhalt Electric Company of Halle was made last week, a piece of financing involving $1,000,000. The company provides electricity for light and power purposes to the cities of Dressau, Halberstadt, Magdeburg, Goethen, Bernburg, Zierbst, Oschersleben (in the Province of Saxony), the Free State of Anhalt and parts of the Free State of Braunschweig and Thueringen. The area served is 7,700 square miles, having a population of about 3,500,000. The issue matures in equal amounts of $250,000 each on July 1, 1926, Jan. 1, 1927, July 1, 1927, and Jan. 1, 1928, at prices yielding from 6.25 to 7.25 per cent.

Another German loan was floated by the Consolidated Hydro-Electric Works of Upper Württemberg—a $4,000,000 issue of first mortgage 7 per cent 30-year sinking fund gold bonds. This company, one of the largest hydro-electric enterprises in Germany, was organized by certain Württemberg counties, and serves a territory comprising approximately one-third of Württemberg.

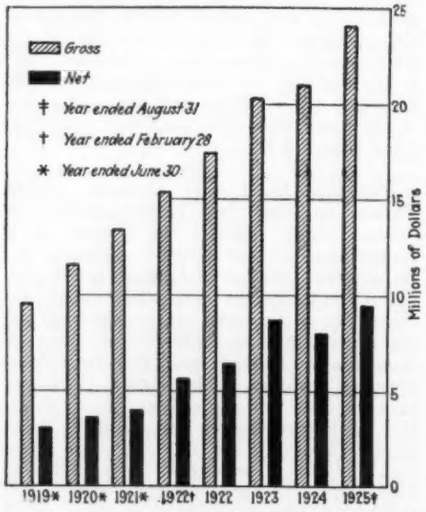
The Silesia Electric Corporation (Elektrizitätswerk Schlesien Aktiengesellschaft) was the third participant in the new German financing to the extent of $4,000,000 in the form of 6½ per cent sinking-fund mortgage gold bonds. These bonds, dated Feb. 1, 1926, and maturing Feb. 1, 1946, were priced at 87⅞ and interest, to yield 7⅞ per cent. Silesia Electric Corporation supplies, directly or indirectly, electric power and light service in the Province of Silesia, reaching a total population estimated at over 2,100,000.

Lehigh Strengthens Its Foundations

In Providing Funds for Acquisition of New Properties Corporation Revamps Financial Set-Up—Annual Gross Earnings Now Total $33,000,000

By PAUL WILLARD GARRETT
Financial Editor *New York Evening Post*

IN FINANCING its recent acquisition of two important properties, the Harrisburg Light & Power Company and the Lancaster County Railway & Light Company, the Lehigh Power Securities Corporation has taken another step forward. Proceeds from the flotation of a twenty-five-million-dollar issue of 100-year debentures are to provide for the retirement of all of the $7,566,000 in ten-year notes called for redemption Feb. 1 and, together with 130,000 shares of six-dollar preferred stock, for the purchase of the new properties. Through a ten-for-one split in its common shares the corporation already had opened the way for greater popularity of its stock among small investors.



GROSS EARNINGS OF LEHIGH POWER SECURITIES SHOW CONSISTENT GROWTH

Upon completion of the present financing Lehigh Power Securities Corporation will have a sound and relatively simple capital structure. (1) It will have a twenty-five-million-dollar issue of 6 per cent gold debentures, series A, due in 2026 (the new issue); (2) it will have outstanding 120,000 shares of no par value of six-dollar cumulative preferred stock of a total authorized issue of 300,000 shares; (3) there will be authorized a three-hundred-thousand-share issue of seven-dollar cumulative preferred stock of which none to date is outstanding, and (4) the common stock will be outstanding at 3,104,450 shares of a total authorized issue of 4,000,000 shares.

Lehigh Power Securities Corporation controls a group of public utility properties once in need of proper rehabilitation and which, under the supervision of the Electric Bond & Share Company for a period of years, have been restored to a position of great strength and been enabled to add materially to the growth of their territory. It is one of the holding companies in this country that serves a compact territory, its principal field of operation being in eastern Pennsylvania. Lehigh Power Securities Corporation owns all of the common stock of the Pennsylvania Power & Light Company, all of that in the Harrisburg Light & Power Company and all of that in the Lancaster County Railway & Light Company and a substantial part of the capital stock of the Lehigh Valley Transit Company. The principal communities served by the Lehigh subsidiaries are Allentown, Bethlehem, Wilkes-Barre, Hazelton, Williamsport, Harrisburg and Lancaster.

As an index of the romantic growth enjoyed by the properties note should be made of the fact that gross earnings, after eliminating intercompany charges, rose from $9,557,936 in 1919 to $24,031,807 for the year ended Aug. 31, 1925, and net earnings in the same period rose from $3,115,448 to $9,414,203. The consolidated earnings statement of the Lehigh Power Securities

Corporation and its subsidiaries for the year ended Dec. 31, 1925, taking into account the addition of the two new properties, were $33,316,487. After deducting $20,440,793 for operating expenses, maintenance and taxes there was left $12,875,793 in net earnings. After making allowances for all other charges, the amount available for interest was $3,661,973.

New Capital Issues

The Standard Gas & Electric Company made an offering on Wednesday of 6 per cent gold debentures, priced at 97½ and interest, to yield about 6.20 per cent, a piece of financing involving a total of $7,500,000. Proceeds will provide funds to be used in payment of indebtedness incurred in the acquisition of a controlling stock interest in the California Oregon Power Company and the Wisconsin Public Service Corporation.

The National Power & Light Company issued 100,000 shares of cumulative preferred stock at $100 a share and accrued dividends to yield 7 per cent. The preferred stock takes precedence as to earnings and assets over 2,562,195 shares of common stock of no par value to be outstanding with the public, having a present aggregate market value of approximately $75,000,000.

Dividends Declared

Name of Company	Per Cent	When Payable
Broad River Power, pf	1¾	Feb. 1
Brooklyn Edison	2	Mar. 1
Cambridge Electric Light	$1	Feb. 1
Central & Southwest Utilities, pf	$1.75	Feb. 15
Central & Southwest Utilities, pr. ln.	$1.75	Feb. 15
Central Illinois Public Service, pf	$1.50	Apr. 15
Cities Service, com.*	½	Mar. 1
Cities Service, com. †	½	Mar. 1
Cities Service, pf. and pf. B*	½	Mar. 1
Columbia Gas & Electric, com	.65	Feb. 15
Columbia Gas & Electric, pf	1¾	Feb. 15
Connecticut Ry. & Ltg., com and pf.	1½	Feb. 15
Consolidated Gas, com	$1.25	Mar. 15
Consumers Power, 6% pf	$1.50	Apr. 1
Consumers Power, 6.6% pf	$1.65	Apr. 1
Consumers Power, 7% pf	$1.75	Apr. 1
Consumers Power, 6% pf.*	.50	Feb. 1
Consumers Power, 6% pf.*	.50	Mar. 1
Consumers Power, 6% pf.*	.50	Apr. 1
Consumers Power, 6.6% pf.*	.55	Feb. 1
Consumers Power, 6.6% pf.*	.55	Mar. 1
Consumers Power, 6.6% pf.*	.55	Apr. 1
Dallas Power & Light, pf	1¾	Feb. 1
Detroit Edison, cap	2	Apr. 20
Duquesne Light, 1st pf., A	1¾	Mar. 15
Edison Elec. Ill., of Brockton	.62½	Feb. 1
Fairbanks, Morse & Co., pf	1¾	Mar. 1
Ingersoll-Rand, new, com	.75	Mar. 1
Lawrence Gas & Electric	.62½	Feb. 1
Lowell Electric Light	.62½	Feb. 1
Michigan Gas & Electric, pr. ln.	1¾	Feb. 1
Michigan Gas & Electric, pf	1¾	Feb. 1
Minnesota Elec. Distributing, com.*	1	Feb. 10
Montreal Light Heat & Power	2	Feb. 15
National Power & Light, pf	.10	Mar. 1
North American Edison, pf	$1.50	Mar. 1
North West Utilities, pf	$1.75	Feb. 15
Pacific Lighting, com	4	Feb. 15
Pacific Lighting, pf	1¾	Feb. 15
Penn-Ohio Power & Light, 8% pf	2	May 1
Penn-Ohio Power & Light, 7% pf	1¾	May 1
Penn-Ohio Power & Light, 7.2% pf	.60	Mar. 1
Penn-Ohio Power & Light, 7.2% pf	.60	Apr. 1
Penn-Ohio Power & Light, 7.2% pf	.60	May 1
Philadelphia Company, pf	$1.25	Mar. 1
Public Service Corp., com	$1.25	Mar. 31
Public Service Corp., 8% pf	2	Mar. 31
Public Service Corp., 7% pf	1¾	Mar. 31
Public Service Corp., 6% pf	1½	Mar. 31
Public Service Elec. & Gas, 7% pf	1¾	Mar. 31
Public Service Elec. & Gas, 6% pf	1½	Mar. 31
Radio Corp., pf. A	1¾	Apr. 1
Tampa Electric	2½	Feb. 15
Tri-State Utilities, com.*	½	Feb. 10
White (J. G.) & Company, com.‡	6	Feb. 1
White (J.G.) & Company, pf	1½	Mar. 1
White (J. G.) Engineering, pf	1½	Mar. 1
White (J. G.) Management Corp., pf	1¾	Mar. 1
Wisconsin Power & Light, pf	$1.75	Mar. 15

* Monthly. † Payable in common stock. ‡ Annual.

Detroit Edison Annual Report.—The annual report of the Detroit Edison Company, just issued to stockholders, contains a condensed comparison of

Security Issues of Electric Service Companies in January

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Pennsylvania Gas & Electric Co	$1,000,000	14	Sinking fund gold debentures, series A		6	95½	6.50
Staten Island Edison Corp	3,307,500	..	First preferred stock	Additions and extensions and for other corporate purposes	6	94½	6.35
Columbus Electric & Power Co	2,500,000	3	Gold notes	To purchase property, assets and franchises of other companies and for construction	5	98.80	5.45
	2,500,000	..	Cumulative preferred stock		7	100	7
Wisconsin Public Service Corp	3,938,000	32	First lien and refunding mortgage gold bonds, series B	To reimburse for additions and extensions	5½	99	5.55
Northern Ohio Traction & Light Co	2,500,000	15	Debentures	To reduce outstanding indebtedness and for other corporate purposes	6½	97½	6.75
Wisconsin Valley Power Co.*	600,000	25	First mortgage gold bonds	To retire bonds of utilities recently acquired and for other corporate purposes	5½	98½	5.60
Pennsylvania Power & Light Co	10,000,000	27	First and refunding mortgage gold bonds, series D	To reimburse for additions and betterments and to provide funds for capital expenditures and other corporate purposes	5	98½	5.10
Florida Power & Light Co	30,000,000	28	First mortgage gold bonds	Acquisition of other utilities	5	93½	5.45
Penn Central Light & Power Co	6,515,542	..	Cumulative preferred stock		5	73	6.85
Western United Gas & Electric Co	22,500,000	29	First mortgage gold bonds, series A	To provide cost of acquiring new properties and to retire funded indebtedness outstanding against these properties	5½	99	5.55
Sioux City Service Co	1,350,000	25	First mortgage gold bonds	To retire present indebtedness, for additions and betterments and for other corporate purposes	6	99	6.08
American Utilities Co	1,250,000	19	First lien and refunding gold bonds, series A	To purchase properties and to provide working capital	6	97½	6.22
Central States Power & Light Corp	1,000,000	19	First collateral lien gold bonds	To purchase bonds of subsidiary companies and for other corporate purposes	6	99	6.09
Northeastern Power Corp	10,500,000	..	Common stock	For acquisition of securities and for the development of the system	..	35	....
Buffalo General Electric Co	10,000,000	30	General and refunding mortgage gold bonds, series A	To provide funds for or to reimburse for construction expenditures and to increase its working capital	5	99	5.05
General Public Service Corp	2,672,200	..	Convertible preferred stock		7	100	7
Lehigh Power Securities Corp	25,000,000	100	Gold debentures, series A	To retire indebtedness, for the acquisition of new properties and to provide funds for capital expenditures and for other corporate purposes	6	95	6.30
Commonwealth Edison Co	15,000,000	30	First mortgage collateral gold bonds series C	To partially reimburse company for capital expenditures heretofore made	4¼	93	4.95
North West Utilities Co	2,850,000	..	Cumulative preferred stock	To acquire securities of subsidiary and allied companies, for refunding and other corporate purposes	7	95	7.37
Cities Service Co	10,000,000	40	Gold debenture bonds	Refunding	6	93½	6.45
Electrical Securities Corp	1,000,000	30	Collateral trust sinking fund gold bonds		5	96¼	5.25
Texas-Louisiana Power Co	3,250,000	20	First mortgage gold bonds, series A	To reimburse for capital expenditures, for additions and betterments and for other corporate purposes	6	99	6.08
Total	$168,233,242						

* December issue not included in total.

1925 with 1924, showing a gross revenue of $38,948,783 in 1925 against $34,-163,287 in 1924, an increase of 14 per cent; a gross income of $12,609,792, or an increase of 22.8 per cent over that of 1924, and a net income for 1925 of $8,390,289, or an increase of 37.5 per cent over the previous year. The year 1925 was reported as a good year for the company, and fair progress was made with the plans for construction announced a year ago. The output of electric energy from power houses was 1,732,420,700 kw.-hr., the corresponding figure for the previous year being 1,460,631,400 kw.-hr. The addition during the year to the fixed plant investment account was $18,577,147. The addition to the same account in 1924 was $24,825,918.

Byllesby Shifts Stock Holdings to Subsidiary.—Holdings of H. M. Byllesby & Company in the Standard Power & Light Corporation of Delaware have been turned over to the Standard Gas & Electric Company, Byllesby's principal subsidiary, so that the Standard Gas jointly with Ladenburg, Thalmann & Company, bankers, controls the Delaware organization.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Jan. 30	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com. —no par	k 82¼	71¼	84¼
Adirondack Pwr. & Lt.—7% pf.	k103	....	....
Adirondack Pwr. & Lt.—8% pf.	109	n103	n115
Adirondack Pwr. & Lt., com.—50	m 75	n 31	n 98
Ala. Pwr., pf.	k104½	....	....
Allis-Chalmers Mfg. pf.	109½	109	110
Allis-Chalmers Mfg., com.	k 91¼	90	94½
Aluminum Co. of Amer., com.	k 63	55	65½
Aluminum Co. of Amer. new, pf.	k 98½	....	....
Amer. & Foreign Pwr., pf. 25% pd.	n127½	127½	131
Amer. & Foreign Pwr., 7% pf.—no par	k 93	91¼	94
Amer. & Foreign Pwr., com.—no par	k 40½	37	42¾
Amer. Bosch Magneto, com—no par	k 29½	28½	34¼
Amer. Brown Boveri, Elec.	k 44½	43¼	48¾
Amer. Elec. pwr., pf.	c103	101¼	103
Amer. Gas & Elec., 6% pf.—no par	k 94	92½	95½
Amer. Gas & Elec., com.—no par	k 94½	80	99½
Amer. Lt. & Trac., 6% pf.	k114½	114	116½
Amer. Lt. & Trac., com.	k255	232	263
Amer. Pwr. & Lt., 6% pf.	k 94	93½	96
Amer. Pwr. & Lt., com.—no par	k 75½	68¼	79½
Amer. Pub. Serv., 7% pf.	k 96½	....	....
Amer. Pub. Serv., com.	47	n 45	n 90
Amer. Pub. Utilities, 4% pf.	82	....	....
Amer. Pub. Utilities, 6% pf.	k 83	....	....
Amer. Pub. Utilities, 7% pf.	k 86	....	....
Amer. Pub. Utilities, com.	78	n 70	n103
Amer. States Sec., A	k 7½	....	....
Amer. States Sec. B	k 5	....	....
Amer. Superpwr., pf.—25	25¼	25¼	25¼
Amer. Superpower, pf.	93	n 92	n 95½
Amer. Superpwr., Class A—no par	k 34	33½	37¾
Amer. Superpwr., Class B—no par	k 34½	34½	39
Amer. Wtr. Wks. & Elec., 7% pf.	105	102½	108½
Amer. Wtr. Wks. & Elec., com.—20	k 71¾	68	74
Anaconda Copper	k 48	46¼	50¾
Appalachian Pwr., 7% pf.	100	n 92	n101
Appalachian Pwr., 1st pf., 7%	100	n 95	n101
Appalachian Pwr., com.	78	n 70	n 83
Arizona Pwr., 7% pf.	k 80	....	....
Arizona Pwr., com.	35	n 15	n 34½
Arkansas Cent. Pwr., pf., $7—no par	101½	n 97	n102
Arkansas Lt. & Pwr., 7% pf.	k 99	....	....
Arkansas Lt. & Pwr., com.	100	n 65	n101
Asheville Pwr. & Lt., 7% pf.	l101½	100½	102½
Assoc. G.&E., 7% pf.—1% extra—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 80	....	....
Assoc. Gas & Elec., Class A—no par	k 32½	31½	35½
BABCOCK & WILCOX, com.	k145	....	....
Binghamton Lt., Ht. & Pwr., pf.	102	n 90	n101
Birmingham Elec. pf.—$7—no par	102	n 98	n103
Blackstone Valley Gas & Elec., pf.	101	n 95	n100
Blackstone Valley G.&E., com.—50	k102½	97	118½
Blaw-Knox, com.	m 54½	54	56
Brazilian Trac., Lt. & Pwr., com.	f 94½	....	....
Broad River Pwr., pf.	93	n 90	n 97
Brooklyn Edison, com.	k145½	133½	146½
Buffalo Gen. Elec., com.—no par	m 58	n 50	n 77
Buffalo, Niagara & East. Pwr., pf.—25	k 24¼	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	k 35	....	....
CALIFORNIA ELEC. GENERATING, pf.	92	n 89	n 93
California Ry. & Pwr., pf.	87	n 88	n100
Carolina Pwr. & Lt., pf.—$7—no par	105½	n100	n107
Carolina Pwr. & Lt., com.	420	n290	n456½
Cent. & S. W. Ut. 7% pf.—no par	a 93	89½	94
Cent. & S. W. Ut., pr. in. pf.—no par	m 98	n 92	n100
Central Ariz. Lt. & Pwr., pf.	101	n100	n106
Central Ark. Ry. & Lt., 7% pf.	k100	....	....
Central Ill. Pub. Serv., 6% pf.	89	n 84	n 93
Central Ind. Pwr., 7% pf.	88½	n 88	n 95
Central Pwr. & Lt. pf.	k 95½	....	....
Central States Elec., 7% pf.	k 93	....	....
Central States Elec., com.	200	n 70	n250
Century Elec., com.	m103	n103	n110
Chicago Fuse Mfg., com., no par	a 33½	32	34
Cincinnati Gas & Elec., com.	g 90½	89	90
Cities Service, 6% pf.	k 83½	....	....
Cities Service, pf.B—10	k 7½	....	....
Cities Service, pf. BB—100	k 77	....	....
Cities Service, com.—20	k 38½	....	....
Cities Service, Bks. Shrs.—10	k 17½	....	....
Clarion River Pwr., pf.	93	n 91	n 96
Cleveland Elec. Illg., 6% pf.	102	n101	n105
Cleveland Elec., Illg., com.	k240	....	....
Colorado Pwr., 7% pf.	k 96	....	....
Columbia Gas & Elec., 7% pf.	113½	113¾	115
Columbia Gas & E., com.—no par	k 84½	83¼	90
Columbia Ry., Gas & Elec., 6% pf.	90	n 90	n 90
Columbus Elec. & Pwr., 2d pf.	k100	....	....
Columbus Elec. & Pwr., com.	k157	....	....
Columbus Ry., Pwr. & Lt., pf. A	98	n 86	n 99
Columbus Ry., Pwr. & Lt., pf. B	92	n 80	n 85
Col. Ry., Pwr. & Lt., com.—no par	82	n 70	n 85
Commonwealth Edison, com.	a142	139½	144
Commonwealth Pwr., 6% pf.	k 87	85	87½
Commonwealth Pwr., com—no par	k 40½	39	42¾
Conn. Lt. & Pwr., 8% pf.	118	n115	n118
Conn. Lt. & Pwr., 7% pf.	110	n105	n110
Cons. Gas of N. Y., pf.—50	k 59½	....	....
Cons. Gas of N.Y., com.—no par	k 98½	94½	100
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	e102	102	103
Cons. Gas, Elec. Lt. & Pwr. of Balti 6½% pf.	e109½	108½	110
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e111½	110½	111½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e127	124	127
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	e 50	45	52½
Cons. Utilities of Dela., 7% pf.	m 85	n 80	n 84
Consumers Pwr., 6% pf.	97	n 90	n 97
Consumers Pwr., 6.6% pf.	102	n 97	n102
Continental Gas & Elec., 7% ptc. pf	k100	....	....
Continental Gas & Elec., 7% pr. pf.	95	n 89	n 97
Continental G.&E., com.—no par.	143	n 77	n152
Crocker Wheeler, com.	9	n 9	n 28
Crocker Wheeler, pf.	45	n 47	n 80
DALLAS PWR. & LT., 7% pf.	102	n100	n102½
Dayton Pwr. & Lt., 6% pf.	97	n 88	n100
Dayton Pwr. & Lt., com.	420	n180	n460
Detroit Edison, com.	k140½	133	140½
Dubilier Condenser & Radio, com. no par.	k 8½	8	11
Dubuque Elec., 7% pf.	94	n 80	n 90
Duquesne Lt., 7% pf.	m112½	112½	113
EAST, N. Y. UTIL, pf.	70	n 71	n 80
Eastern New York Utli., com.	55	n 52	n 65
Eastern States Power	k 32	....	....
Eastern States Pwr., pf. with warrants	m120	....	....
Eastern States Pwr., pf. without warrants	k 92	....	....
Eastern Tex. Elec., 7% pf.	k101	....	....
East. Tex. Elec., com.—no par	k100	....	....
Edison Elec. Illum. of Boston, com.	d210	207	211
E. Paso Elec., com.—no par	k 84	....	....
E. Paso Elec. pf.	k101	....	....
Elec. Bond & Share, 6% pf.	l105	103½	107½
E. Bd. & Share Sec., com.—no par.	l80	79	86
Elec. Investors, 6% pf.—no par	92	n 95	n 96
Elec. Investors, com.—no par	k 69½	66	74½
Elec. Investors, 10% pd. receipts	50	n 15	n 62
Elec. Pwr. & Lt., ctfs, pf.	k 94½	91½	94½
Elec. Pwr. & Lt., ctfs., 40% pd.	k109½	105½	109½
Elec. Pwr. & Lt., ctfs. full pd.	107	107	107½
Elec. Pwr. & Lt., ctfs., com.—no par	k 33½	30	32½
Elec. Ry. Securities, com.—no par.	k 9½	4½	10
Elec. Refrig.	k 82½	78½	90½
Elec. Storage Battery, com.—no par.	k 75½	73	75½
Elmira Wtr., Lt. & R. R., 7% pf.	98	n 93	n 98
Emerson Elec. pf.	m104½	100	104½
Empire Dist. Elec., 6% pf.	80	n 78	n 85
Empire Pwr., A.	k 32½	....	....
Eng. Pub. Serv., pf.—no par	l101	99	102
Engr. Pub. Serv., com.—no par	k 27½	24	29½
Eureka Vac. Cleaner, com.—no par	k 52½	47½	53½
FAIRBANKS MORSE, com—no par	k 55½	51	57½
Fairbanks Morse, pf.	m108½	n 51	n 51
Federal Lt. & Trac., com.	k 38½	35½	39
Federal Light & Traction, pf.	m 85½	n82½	n 86
Federal Utilities, pf.	k 75	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l105½	105	107
GALVESTON-HOUSTON ELEC., 6% pf.	k 61	....	....
Galveston-Hstn El., com.	k 21	....	....
Gen. Elec., com.	k340	323	347½
Gen. Elec., special—10	k 11½	11	11½
Gen. Gas & Elec., A.	k 51½	51¾	59
Gen. Gas & Elec., pf. A.	k 98½	98¼	99½
Gen. G.&E., (Del.) com. A no par.	52½	n 42	n 64½
Gen. G.&E., (Del.) com. B no par.	40	n 40	n 62
Gen. G.&E., (Del.) A pf. $8 no par.	108	n 90	n111
Gen. G.&E., (Del.) A pf. $7 no par.	98½	n 97½	n100
Gen. G.&E., (Del.) B pf. $7 no par.	96	n 88	n 97½
Ga. Lt., Pwr. & Rys., 6% pf.	80	n 74	n 85
Ga. Lt., Pwr. & Rys., com.	59	n 25	n 74
Ga. Ry. & Elec., 5% pf.	m 70	n 78½	n 84½
Ga. Ry. & Elec., com.	m126	n115½	n115½
Ga. Ry. & Pwr., 8% pf.	112	n101	n114
Ga. Ry. & Pwr., 7% pf.	101	n100	n102½
Ga. Ry. & Pwr., 4% pf.	141	n 62	n150
Ga. Ry. & Pwr., com.	k138	....	....
Gt. Western Pwr., 7% pf.	k101	....	....
HAVANA ELEC. UTIL., com.	43½	43½	44¾
Havana Elec. Util., pf.	m 69	66	n 70
Hurley Machine, com.—no par	a 50½	44½	51
IDAHO PWR., 7% pf.	102	n 97½	n102
Ill. No. Utilities, 6% pf.	k 88	....	....
Ill. Pwr. & Lt., 7% pf.	k 97½	....	....
Ingersoll Rand	k 93	90	105
Int. Combt. Engr., com.—no par.	k 59	53½	64½
Int. Utilities, class A—no par.	k 37½	....	....
Int. Utilities, class B—no par.	k 8	....	....
Interstate Pwr., pf., $7 no par.	92	n 90	n 98
Interstate Pub. Serv., 7% pf.	96½	n 90	n100
Iowa Ry. & Lt., 7% pf.	97	n 92	n100
JERSEY CENTRAL PWR. & LT. 7% pf.	95½	n 90	n 96
Jersey Central Pwr. & Lt., com.—no par	45	n 15	n 50
Johns-Manville, com.—no par.	k150	148	159
KANSAS CITY PWR. & LT., pf.	k108	107½	109
Kansas Gas & Elec., 7% pf.	l101	99½	102
Kelvinator Corp., com.—no par.	k 81½	81	89½
Kentucky Hydro-Elec., pf.	a 94½	92	95
Kentucky Sec., 6% pf.	75	n 67	n 78
Kentucky Sec., com.	k 90	....	....
Kentucky Utilities, 6% pf.	90	n 82	n 95
Keystone Pwr. & Lt. 7% pf.	95	n 90	n 95
Kings County Ltg., 7% pf.	101	n 98	n101
Kings County, Ltg., 8% pf.	104	n103	n106
LACLEDE GAS LT., com.	160	160½	168
Lehigh Pwr. Sec., com.—no par.	k 21½	21	22
Long Island Ltg., 7% pf.	106	n100	n105
Long Island Ltg., com.—no par.	145	n 60	n142
Los Angeles Gas & Elec., 6% pf.	95	n 90	n 98
Louisville Gas & Elec., Class. A.	k 24½	22¾	25½
MANHATTAN ELEC. SUPPLY.	k 67	56	67½
Manila Elec., com.—no par.	31¾	32	32½
Maytag Mfg., com.	k 22½	21½	22½
Memphis Pwr. & Lt., pf., $7, no par	103	n 98½	n102
Metro. Edison, pf.—$6—no par.	92½	n 92	n 96
Metropolitan Edison, pf., $7, no par.	102½	n100	n110
Metropolitan Edison, com., no par.	45	n 45	n 50
Middle West Utilities, 7% pf.	a103½	97½	103
Middle West Utilities, 7% pr. lien pf.	a113	106½	115½
Middle West Utilities, com.—no par.	a128	115½	134½
Midland Utilities, pr. in. pf.	a 99½	99	99½
Midland Utilities pf. A	a 96	96	96½
Milwaukee Elec. Ry. & Lt., 7% pf.	99	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	87	....	....
Minn. Pwr. & Lt., 7% pf.	l102	100½	103
Miss. Pwr. & Lt., pf.	k102	....	....
Miss. River Pwr., 6% pf.	95	n 87½	n 94
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par	103	n101	n105
Mohawk Hudson Pwr., 2nd pf.—$7—no par	k 94	....	....
Mohawk Hudson Pwr., com.—no par	k 21	....	....
Montana Pwr., pf.	m 118	112½	118
Montana Pwr., com.	k 82½	77¼	83½
Montreal Pwr., com.	f 217	....	....
Mountain States Pwr., pf.	k 95	....	....
Mountain States Pwr., com.	k 24	....	....
NASSAU & SUFFOLK. LTG., pf.	92	n 88	n 95
National Carbon, com.	m124	n120	n130
National Carbon, pf.	m127½	n120	n137½
National Elec. Pwr., pf.	a 95½	93	95½
National Electric Pwr-A	k 26	24½	26¾
Nat.-Lt., Ht. & Pwr., com.—no par.	24	n 11	n 30
National Lt., Ht. & Pwr., 5% pf.	71	n 40	n 72
National Pwr. & Lt., pf., $7—no par.	k101½	101½	102½
National Pwr. & Lt., com.—no par.	m 36½	34½	38¾
National Pub. Serv., 7% pf.	90	n 90	n 96
National Pub. Serv., ptc. pf.	94	n 93	n 97½
National Pub. Serv., A com.—no par	k 22½	22	24
National Pub. Serv., B com.—no par	17	13½	17½
Nebraska Pwr., 7% pf.	l104	103	105½
Nevada-Calif. Elec., com.	m 36	30½	42
New Brunswick Pwr., pf.	35	n 30	n 40
New England Pub. Serv., pr. in. pf.	98	n 97½	n 99
New England Pub. Serv., pf.	95	n 95½	n 97
N. J. Pwr. & Lt., 7% pf.	104	n 92	n102
New Orleans Pub. Serv., 7% pf.	101	n 94	n102
New Orleans Pub. Serv., com.—no par	m 30	n 31	n 38½
N. Y. Central Elec., 7% pf.	99	n 96	n101
Newport News & Hampton Ry., Gas & Elec., com.	105	n 85	n100
Newport News & Hampton Ry., Gas & Elec., pf.	95	n 90	n105
Niagara Falls Pwr., 7% pf.—25	28	28	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	m101	n101½	n110
Niagara, Lock. & Ont. Pwr., com.—no par	m 60½	n 60	n 73
Nizer Corp., A.—no par	m 84½	n 37	n 84½
Nizer Corp., B.—no par	k 81½	76	89¾
No. Amer., 6% pf.—50	k 50	49	50½
No. Amer., com.—10	k 64½	63½	67
No. Amer. Edison pf.—no par	k 94	92½	95½
No. Amer., Lt. & Pwr., pf.	88	n 87	n 91
N.C. Pub. Serv., pf.—$7—no par.	k 91	....	....
Northeastern Pwr., com.	k 34½	34	36½
No. Indiana Gas & Elec., pf. A.	98	n 96	n 98½
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 24½	15½	26½
No. Ohio Trac. & Lt., 6% pf.	75	n 64	n 75
No. Ohio Trac. & Lt., 7% pf.	85	n 85½	n 88
No. Ont. Lt. & Pwr., pf.	k 76	....	....
No. Ont. Lt. & Pwr., com.	63½	n 41	n 52
No. States Pwr., 7% pf.	k100½	100	101½
No. States Pwr. com.	k128	125½	136¾
No. Texas Elec., 6% pf.	k 61	....	....
No. Texas Elec., com.	k 42	....	....
OHIO BRASS, com. B—no par	k 79	79	79½
Ohio Brass, pf.	99	n 92	n102
Ohio Gas & Elec., 7% pf.	90	n 87	n100
Ohio Pwr., 6% pf.	93	n 85	n 95
Ohio Pub. Serv., 6% pf.	89	n 88	n 93
Ohio Pub. Serv., 7% pf.	99	n 97	n100
Ohio River Edison, pf.	100	n 93½	n100½
Oklahoma Gas & Elec., pf.	k 95	....	....
PACIFIC GAS & ELEC., 6% pf.	k 97½	....	....
Pacific Gas & Elec. com.	131	126½	132½
Pacific Pwr. & Lt., 7% pf.	l 98½	98	101

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, Feb. 2. lBid, low, high, Wednesday, Feb. 3. mLatest quotations available, n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday Jan. 30	Low 1926	High 1926
STOCKS—Continued			
Parr Shoals Pwr., 6% pf.	92	n 90	n100
Penn Central Lt. & Pwr., pf.—no par	c 73½	72½	73½
Penn-Ohio Elec., 7% pf.	95	n 83½	n 96
Penn-Ohio Pwr. & Lt., 7% pf.	94	n 91	n100
Penn-Ohio Pwr. & Lt., 8% pf.	101	n101	n110
Penn Pwr. & Lt.—$7—no par	l105	103	106
Penn Pub. Serv., 7% pf.	98	n 90	n100
Penn Pub. Serv., 6% pf.	85	n 80	n 90
Penn Wtr. & Pwr., com.	c162½	160½	171
Phila. Co., pf.—50.	m 48	47½	48½
Phila. Co., com.—50.	k 66½	63	70½
Phila. Elec., com.—25	c 66½	54½	67½
Pittsburgh Utilities, pf.—10	k 16	15½	16½
Portland Elec. Pwr., 7% pf.	97	n 95	n 99
Portland Elec. Pwr., 6% pf.	71	n 70	n 80
Portland Elec. Pwr., com.	k 47	....	....
Portland Ry., Lt. & Pwr.,pf.	m 72	....	....
Portland Ry., Lt. & Pwr., com.	m 41	....	....
Potomac Elec. Pwr., pf.	j107½	....	....
Pwr. Corp. of N. Y., 7% pf.	m110	n 96	n112
Pwr. Corp. of N.Y., com—no par	k 86	79	90½
Pwr. Sec., pf.—no par	k 23	....	....
Pwr. Sec., com.—no par	k 10	....	....
Pub. Serv. of N. J., 7% pf.	k108½	103½	108½
Pub. Serv. of N. J., 8% pf.	118½	115½	119
Pub. Serv. of N. J., com.—no par	k 87½	79½	92½
Pub. Serv. of No. Ill., 6% pf.	a101½	100½	102½
Public Serv. of No. Ill., 7% pf.	a112	112	115
Pub. Serv. of No. Ill., com.—no par	a134	130	137
Pub. Serv. of No. Ill., com.	a135	130	135
Pub. Serv. of Okla., 7% pf.	92	n 87	n 95
Pub. Serv. Elec. & Gas, 6% pf.	k 99½	97	99½
Puget Sound Pwr. & Lt., 7% pf.	k107	....	....
Puget Sound Pwr. & Lt., 6% pf.	k 83	....	....
Puget Sound Pwr. & Lt., com.	k 60	....	....
RADIO CORP. OF AM., pf.—50.	k 46	45½	47½
Radio Corp. of Amer., com.—no par	k 44½	41	46½
Republic Ry. & Lt., pf.	k104	....	....
Republic Ry. & Lt., com.	94	n 49	n 67
Rochester Gas & Elec., 5% pf.	95	n 80	n 98
Rochester Gas & Elec., 6% pf.	99	n 96	n100
Rochester Gas & Elec., 7% pf.	104	n103	n106½
ST. JOSEPH RY., LT., HT. & PWR., pf.	65	n 60	n 65
Servel Corp., Class A	k 27½	26½	30½
Servel Corp., Class B—no par	k 59	....	....
Sierra Pacific Elec., com.	k 25½	25	28½
Sioux City Gas & Elec., 7% pf.	98	n 97½	n 99½
S. E. Pwr. & Lt., 7% pf.—no par	99	n 90	n100
S. E. Pwr. & Lt., com.—no par	k 41½	40½	46½
So. Calif. Edison, 8% pf.	135	n115	n128
So. Calif. Edison, 7% pf.	k111½	....	....
So. Calif. Edison, 6% pf.	k 98½	....	....
So. Calif. Edison, com.	k139	128	141½
Southern Cities Utilities, 7% pf.	86	n 77	n100
Southern Cities Utilities, com.	k 48	....	....
Southern Pwr. & Lt. of Md., pf.	m107	....	....
Southern Pwr. & Lt. of Md., com.	m 32	....	....
Southwestern Lt. & Pwr., A	52	n 52	n 56
Southwestern Lt. & Pwr., B	38	n 31½	n 42½
Southwestern Lt. & Pwr., 6% pf.	78	....	90
South Western Pwr. & Lt., 7% pf.	k 99	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	96	n 92	n 93
Standard Gas & Elec., 8% pf.	k 56½	54½	56½
Standard Gas & Elec., 7% pf.	k100½	....	....
Standard Gas & Elec., com.—no par	k 60½	55½	60½
Standard Pwr. & Lt., 7% pf.	k 90½	....	....
Superheater, com.—no par	k138	....	....
Syracuse Lighting, 7% pf.	105	n103	n107
Syracuse Lighting, 8% pf.	118	....	....
Syracuse Lighting, com.	265	n115	n265
TAMPA ELEC., com.	k304	292	312
Tenn. Elec. Pwr., 6% pf.	k 87	....	....
Tenn. Elec. Pwr., 7% pf.	k101½	....	....
Tenn. Elec. Pwr., pf.—$6—no par.	m 80	....	....
Tenn. Elec. Pwr., com.—no par.	m 65	....	....
Terre Haute, Ind. & East Trac., pf.	27	n 22	n 35
Terre Haute, Ind. & East. Trac., com	3	2½	....
Tex. Pwr. & Lt., 7% pf.	l103	102	104
Tide Water Pwr., 8% pf.	k 99	....	....
Timken Roller Bearing, com—no par	k 54½	52½	56½
Toledo Edison, 8% pf.	111½	n109	n114
Toledo Edison, 7% pf.	k101½	....	....
Toledo Edison, com.	m 25	n 21	n 25
Tri-City Ry. & Lt., 6% pf.	88	n 82	n 85
UNITED GAS & ELEC., 6% pf.	94	n 80	n 94
United Gas & Elec., com.—no par	62	n 26	n 57½
United Gas & Elec. (N.J.), 5% pf.	70	n 55	n 65
United Gas Impr.—50.	c132½	119	144½
United Lt. & Pwr., pf.—$4—no par.	49	n 41	n 51
United L. & P. pf.—$6.50—no par	88	n 83	n 99
United Lt. & Pwr., com., A—no par	130	n 42	n166½
United Lt. & Pwr., com., B—no par	145	n 49	n100
Utah Pwr. & Lt., 7% pf.	l102	99	102½
Utica Gas & Elec., 7% pf.	104½	n100	n104
Utica Gas & Elec., com.	200	n100	n200
Utilities Pwr., & Lt., 7% pf.	92	n 90	n 97
Utilities Pwr. & Lt., com. B—no par.	15	n 12	n 22
VERMONT HYDRO - ELEC., 7% pf.	95	n 87	n 96
Virginia Pwr., 7% pf.	101	n 94	n107
Virginia Pwr., com.	65	n 65	n 92
Virginia Ry. & Pwr., com.	m149	n 64½	n150
WAGNER ELEC., pf.	b 82½	82½	85
Wagner Elec., com.—no par	b 31½	30	34½
Washington Ry. & Elec., com.	f206	....	....
Washington Ry. & Elec., pf.	f 91	....	....
Washington Wtr. Pwr., com.	130	n110	n140
West Mo. Pwr., 7% pf.	k 91	....	....
West Penn., 7% pf. tem. ctfs.	96	96½	97½
West Penn, com.	123½	123	130
West Penn Elec., pf.	k 98	96½	98½
West Penn Elec., Class A	k 91	88½	91
West Penn Pwr., pf.	m109½	109	109½
West Va. Lt., Ht. & Pwr., 7% pf.	94	n 94½	n 96½
West Va. Utilities, 7% pf.—50.	43	n 38	n 47
Western Pwr., 7% pf.	k 99	96	99
Western Pwr., com.—no par	m 80	n 34	n102
Western States Gas & Elec., 7% pf.	89	n 82	n 92
Western States Gas & Elec., com.	k 19½	....	....
Westinghouse El. & Mfg., com—50.	k 73½	72	75½
Weston Elec. Instrument, Class. A.	29	27½	29
Weston Elec. Instrument, com.	k 18½	15½	18½
Wheeling Elec., pf.	90	n 88	n 93½
Wis.-Minn. Lt. & Pwr., 7% pf.	m 90	....	....
Wis. Pwr., Lt. & Ht., 7% pf.	85	n 85	n 90
Worthington Pump, pf. A	76½	77	78½
Worthington Pump, pf. B	61	60	63
Worthington Pump, com.	k 40	37½	44½
YADKIN RIVER PWR., 7% pf.	l103	102	105
Yale & Towne, com.—25	62½	62½	64½
BONDS			
ABITIBI PWR., & PAPER	6s	1940 k100	....
Adir. Elec. Pwr.	5s	1962 k100½	....
Adir. Pwr. & Lt.	6s	1950 k105½	....
Adir. Pwr. & Lt.	5s	1930 97	n 94 n98
Ala. Pwr.	5s	1946 99½	n 96 n100
Ala. Pwr.	5s	1951 97½	n 92½ n 97½
Ala. Pwr.	6s	1951 105	n101½ n105½
Ala. Trac., Lt. & Pwr.	5s	1962 123	n 86 n115½
Aluminum Co. of Amer.	7s	1933 k106½	106½ 107
Amer. Bosch Magneto	8s	1936 m103	....
Amer. Gas & Elec.	5s	2007 92	n 90 n 93½
Amer. Gas & Elec.	6s	2014 k 99½	98 99½
Amer. Pwr. & Lt.	6s	2016 k 97½	96 98
Amer. Pub. Serv.	6s	1942 98½	n 94 n 99½
Amer. Wtr. Wks. & Elec.	5s	1934 97½	95½ 97½
Amer. Wtr. Wks. & Elec.	6s	1975 k 94	94 94½
Anaconda Copper	6s	1929 103½	102½ 103½
Anaconda Copper	6s	1953 102½	101½ 102½
Anaconda Copper	7s	1938 105½	104½ 105½
Appalachian Pwr.	5s	1941 k 98½	....
Appalachian Pwr.	6s	2024 92½	n 87 n 94½
Appalachian Pwr.	7s	1936 105½	n105 n106½
Arizona Pwr.	6s	1933 100	n 97½ n101
Arizona Pwr.	6s	1947 96	n 90 n 96½
Ark. Central Pwr.	6s	1948 102	n 98½ n102½
Ark. Lt. & Pwr.	6s	1945 k103	....
Ark. Lt. & Pwr.	6s	1954 100	n 92½ n 99½
Assoc. Gas & Elec.	6s	1965 k 94½	94½ 95½
Assoc. Gas & Elec.	6½s	1954 k100	....
BINGHAMTON LT., HT. & PWR.	5s	1946 k 99	....
Birmingham Elec.	6s	1954 102½	n 99 n103
Birmingham Ry., L. & P.	4½s	1954 89	n 85 n 89½
Broad River Pwr.	6½s	1934 100½	n 99 n102
Brooklyn Edison	5s	1949 k103½	....
Brooklyn Edison	6s	1930 105½	104½ 105½
Buffalo Gen. Elec. 1st	5s	1939 102	n100½ n102½
Buffalo G. E., 1st & Ref.	5s	1939 101½	n100 n101½
Buffalo G. E.	5s	1956 m100½	99½ 100½
Burlington Ry. & Lt.	5s	1932 96½	n 90 n 96
Butte Elec. & Pwr.	5s	1951 k 99	....
CALIF. ELEC. GEN.	5s	1948 k 99½	....
Calif. Gas & Elec.	5s	1937 k100½	....
Calumet Gas & Elec.	5½s	1960 96½	n 97 n 98½
Canadian Lt. & Pwr.	5s	1949 54	n 36 n 62
Canton Elec.	5s	1937 100	n 99 n100½
Carolina Pwr. & Lt.	5s	1938 100½	n 98½ n100½
Carolina Pwr. & Lt.	6s	1953 k103	....
Cedar Rap. Mfg. & Pwr.	5s	1953 99½	n 98½ n100½
Central Ark. Ry. & Lt.	5s	1928 99½	n 98½ n100
Central Ga. Pwr.	5s	1938 95½	n 93 n 97
Central Ill. Lt.	5s	1943 k 98½	....
Central Ill. Pub. Serv.	5s	1952 90	n 84½ n 92½
Central Ill. Pub. Serv.	5½s	1950 95½	n 96½ n 98
Central Ill. Pub. Serv.	6s	1944 99½	n 96½ n101½
Central Ind. Pwr.	6s	1947 k 98½	....
Central Ia. Pwr. & Lt.	6s	1944 99½	n 96½ n101
Central Maine Power	5s	1939 98½	n 98½ n100
Central N. Y. Gas & El.	5s	1941 k 98½	....
Central Pwr. & Lt.	6s	1946 100½	n 97½ n101½
Central Pwr. & Lt.	6½s	1952 k101½	....
Central States Elec.	5s	1926 m 99	....
Chattanooga Ry. & Lt.	5s	1956 83½	n 81 n 85
Cincinnati Gas & Elec.	5s	1956 103	102½ 103
Cincinnati Gas & Elec.	5½s	1961 104½	102½ 104½
Cities Service	6s	1966 k 93½	92½ 93½
Cities Service	7sB	1966 180	178 180
Cities Service	7sC	1966 k127	126 127
Cities Service	7sD	1966 k102	101½ 102
Cities Service	7sE	1966 k109	....
Cities Service Pwr. & Lt.	6s	1944 k 94½	93½ 94½
City L. & T., Sedalia, Mo.	5s	1952 84	n 74 n 85½
Cleveland Elec. Illum.	5s	1939 102½	n100 n103
Cleveland Elec. Illum.	5s	1954 k102½	....
Cleveland Elec. Illum.	7s	1941 110	n109 n111½
Colorado Pwr.	5s	1953 96	n 93 n 96½
Columbia Gas & Elec.	5s	1927 99½	n 99½ n101
Columbia Ry. Gas & El.	5s	1936 92½	n 92½ n 95
Columbus, Dela. & Marion Elec.	5s	1937 84	n 83 n 88
Columbus, Dela. & Marion Elec.	6s	1937 94	n 91 n 98
Columbus Elec. & Pwr.	6s	1947 k102	....
Columbus Ry., Pwr. & Lt.	5s	1940 k 95	....
Columbus Ry., Pwr. & Lt.	6s	1941 k102	....
Commonwealth Edison	5s	1943 k100½	....
Commonwealth Edison	5s	1953 100	n 98½ n101
Commonwealth Edison	5s	1954 k100	....
Commonwealth Pwr.	5s	1939 k 91½	....
Commonwealth Pwr.	6s	1972 k 95	....
Commonwealth Pwr.	6s	1947 103½	102½ 103½
Community Pwr. & Lt.	6s	1950 98½	n 94½ n 99
Conn. Ry. & Ltg.	4½s	1951 92	91½ 92
Consol. Cities Lt., Pwr. & Trac.	5s	1962 80½	n 75½ n 82½
Consol. Elec.	5s	1955 97½	n 94 n 98½
Consol. Gas of N. Y.	5½s	1945 105½	104½ 105½
Con. Gas. Elec. Lt. & Pwr. of Balti.	4½s	1935 c 97½	97½ 97½
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	6s	1949 c106½	105½ 106½
Con. Gas. Elec. Lt. & Pwr. of Balti.	5s	1965 c100½	100½ 100½
Con. Gas. Elec. Lt. & Pwr. of Balti. (notes)	5½s	1952 105½	105½ 105½
Consumers Elec. L. & P.	5s	1936 k 97	....
Consumers Pwr.	5s	1936 k100½	....
Consumers Pwr.	5s	1952 100	97½ 100
Consumers Pwr.	5½s	1954 k103½	....
Continental Gas & Elec.	5s	1927 k100	....
Continental Gas & Elec.	6s	1947 k100½	....
Continental Gas & Elec.	6½s	1964 k 98½	....
Continental Gas & Elec.	7s	1954 k106½	....
Cumberland County P. & L.	5s	1942 95	n 92 n 96½
DALLAS PWR. & LT.	5s	1949 104	n103 n105½
Dayton Ltg.	5s	1937 100	n 98½ n100½
Dayton Pwr. & Lt.	5s	1941 k 99½	....
Defiance Gas & Elec.	5s	1942 97	n 88½ n 97½
Denver Gas & Elec.	5s	1949 98½	n 97½ n100
Denver Gas & Elec. Lt.	5s	1951 94½	94 95½
Des Moines Elec.	5s	1938 99	n 98 n100½
Detroit Edison	5s	1933 101½	101 101½
Detroit Edison	5s	1940 102½	101½ 102½
Detroit Edison	5s	1949 100½	100 101
Detroit Edison	5s	1955 100½	100½ 101½
Detroit Edison	6s	1932 135	135 135
Detroit Edison	6s	1940 k107½	....
Detroit Edison	7s	1928 m134	....
Detroit Edison	7s	1929 m138	....
Detroit Edison	7s	1930 134½	134½ 134½
Dominion Pwr. & Trans.	5s	1932 95½	n 95½ n 98½
Driver-Harris	8s	1931 96	n 88 n 97
Dubuque Elec.	6s	1942 102½	n 97½ n 102
Duke-Price Pwr.	6s	1949 102½	n 98½ n103
Duquesne Lt.	6s	1949 106½	105½ 107
Duquesne Lt.	5½s	1949 k106½	....
Durham Pub. Serv.	7s	1949 100	n 97½ n101½
EAST PENN. ELEC.	6s	1953 104½	n100½ n105½
East Oregon Lt. & Pwr.	6s	1929 100	n 97½ n100½
East. Tex. Elec.	5s	1942 k 96	....
Economy Lt. & Pwr.	5s	1956 99	n 96 n 99½
Edison Elec. Illum. of Boston (notes)	4½s	1928 99½	n 98 n100½
Edison Elec. Illum. of Bklyn.	4s	1939 93	93 93
Edison El. Illum. (N.Y.)	5s	1995 103½	103 103½
El Paso Elec.	5s	1932 k102	....
El Paso Elec.	5s	1950 95	n 95 n96
El. Pwr. Corp. (Germany)	6½s	1950 87	85½ 87
Elec. Refrigeration	6s	1936 k105½	104½ 107
Elmira Wtr., Lt. & R.R.	5s	1956 96	n 92½ n 97
Empire Dist. Elec.	5s	1949 91½	n 86½ n 93
Erie Ltg.	5s	1967 98	n 95½ n 99½
Evansville G. & El. Lt.	5s	1932 99	n 96 n100
FEDERAL LT. & TRAC.	5s	1942 94½	93½ 94½
Federal Lt. & Trac.	6s	1942 103	101½ 103½
Federal Lt. & Trac.	6s	1954 k 94	....
Florida Power & Light	5s	1954 k 93½	93½ 93½
Florida Publ. Service	6s	1955 96½	n 96½ n 99
Florida Public Service	6½s	1949 99½	n 99 n103
Ft. Smith Lt. & Trac.	5s	1936 75½	75 78
Fr. Worth Pwr. & Lt.	5s	1931 99½	n 99 n100½
GALVESTON ELEC.	5s	1940 90	n 86½ n 93½
General Elec.	3½s	1942 87½	87½ 88½
Georgia Carolina Pwr.	5s	1952 86½	n 82 n90
Ga. Lt., Pwr. & Rys.	5s	1941 87½	n 86½ n 90½
Ga. Ry. & Elec.	5s	1932 98½	n 98½ n100½
Ga. Ry. & Elec.	5s	1949 92½	n 88 n 94½
Ga. Ry. & Pwr.	5s	1954 95½	n 89½ n 96
Ga. Ry. & Pwr.	6s	1947 k104	....
Ga. Ry. & Pwr.	7s	1941 k105	....
German Gen. Elec.	7s	1945 97	95 97½
German Gen. Elec.	6½s	1940 96	93½ 96½
Great Cons. Elec. Pwr. (Japan)	6½	1950 k 85½	85½ 86
Great Cons. Elec. Pwr. (Japan)	7s	1944 93½	91 93½
Great Falls Pwr.	5s	1940 101½	101½ 101½
Great Northern Pwr.	5s	1935 99½	n 96 n100
Great Western Pwr.	5s	1946 k 99	....
Great Western Pwr.	5½s	1955 98½	n 96 n 99½
Great Western Pwr.	6s	1949 k102	....
Great Western Pwr.	6s	1952 101½	n 99½ n102½
HAMBURG ELEC.	7s	1935 k 95½	94 95½
Havana Elec. R., Lt. & P.	5s	1954 92½	92½ 93
Holtwood Pwr.	6s	1954 103½	n100 n104½
Houston Ltg. & Pwr.	5s	1931 100½	n 98½ n101
Houston Ltg. & Pwr.	5s	1953 94	n90½ n95½
Houston Ltg. & Pwr.	5½s	1954 101½	n 97 n102½
Hydraulic Pwr.	5s	1951 101	n 99½ n102
Hydraulic Pwr.	5s	1950 101	n100 n103
IDAHO PWR.	5s	1947 96½	93 97½
Ill. Elec. Pwr.	6s	1943 102½	n 99½ n103½
Ill. Pwr.	5s	1933 93½	n 93 n 95½
Ill. Pwr.	6s	1944 k 98	....
Ill. Pwr. & Lt.	5½s	1954 97½	n 97½ n 98½
Ill. Pwr. & Lt.	6s	1953 101	n100½ n102½
Ill. Pwr. & Lt.	7s	1953 103	n 99 n104
Ind. Elec.	6s	1947 98	n 96 n 99½
Ind. Gen. Serv.	5s	1948 97½	n 92 n 97½
Ind. Lighting	4s	1958 83½	n 78 n 84
Indiana & Mich. Elec.	5s	1957 99½	n 97½ n 99½
Indiana & Mich. Elec.	5s	1955 96½	n 95 n 98
Ind. Pwr.	7½s	1941 m105½	n104 n106
Ind. Service	5s	1950 91½	n 86½ n 92
Ind. Service	6s	2020 87½	n 73 n 88½
Ingersoll-Rand	5s	1935 100	....
Interstate Elec.	6s	1933 95	n 95 n 99½
Interstate Pwr.	6s	1944 k 97½	....
Interstate Pwr.	7s	1934 k101	....
Interstate Pub. Serv.	6s	1948 98½	n 96 n100½
Iowa Ry. & Lt.	5s	1932 98½	n 97 n 99½
Iowa Southern Utilities	5½s	1950 95½	n 92½ n 97½
JERSEY CENT. PWR. & LT.	5½s	1945 95½	n 95 n 98
KANSAS CITY PWR. & LT.	5s	1952 k101	....
Kansas Elec. Pwr.	6s	1937 100½	n 97½ n102
Kansas Elec. Pwr.	6s	1943 100½	n 97½ n102
Kansas Gas & Elec.	6s	1952 102	101½ 103½
Kansas Gas & Elec.	6s	2022 92	n 86½ n 94½

Stock Exchange: *c*Chicago; *b*St. Louis; *e*Philadelphia; *d*Boston; *e*Baltimore; *f*Mont real; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, Feb. 2. *l*Bid, low, high, Wednesday, Feb. 3. *m*Latest quotations available, *n*1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies		Bid Price Saturday Jan. 30	Low 1926	High 1926
BONDS (Continued)				
Kentucky Hydro Elec....	6s	1949	100¼	n 99½ n101
Kentucky Utilities.....	6s	1949	100	n 97 n101½
Kings Cty. Elec. L. & P..	5s	1937	102	102 102
Kings Cty. Elec. L. & P..	6s	1997	122	120 122
Kings County Ltg.....	5s	1954	99	98 100
Kings County Ltg.....	6¼s	1954	107	107 108
Knoxville Ry. & Lt.....	5s	1946	94	n 88 n 95
LACLEDE GAS LT.....	5s	1934	101	100 101
Laclede Gas Lt.....	5½s	1953	103	102 104
Laurentian Pwr.....	6s	1936	100	n 96 n100½
Laurentide Pwr.....	5s	1946	99½	n 97 n100
Lehigh Pwr. Sec. (notes)..	6s	1927	100	100 101
Lehigh Pwr. Sec.....	6s	2026	k 95	95 95
Lincoln Gas & Elec.....	5s	1941	93	n 91 n 95
Long Island Ltg.....	5s	1936	k100	....
Long Island Ltg.....	6s	1954	104	100 101
Long Island Ltg.....	6s	1948	105	n102 n105
Los Angeles Gas & Elec..	5s	1939	k 99	....
Los Angeles Gas & Elec..	5½s	1943	99	n 94 n 99½
Los Angeles Gas & Elec..	5½s	1947	k100	....
Los Angeles Gas & Elec..	5½s	1949	98	n 95½ n 99½
Los Angeles Gas & Elec..	6s	1942	103	n101 n104
Louisiana Pwr.....	6s	1944	98	n 97 n 99
Louisville Gas & Elec....	5s	1952	k 98	....
Louisville Gas & Elec....	5½s	1954	103	n 99 n103½
Lower Austrian Hydro El.	6½s	1944	87	87 87
Luzerne Cty. Gas & El...	5s	1948	98	n 97 n 99
Luzerne Cty. Gas & El...	7s	1944	104	n 99½ n104
Luzerne Cty. Gas & El...	6s	1954	103	n 99 n105
MADISON RIV. PWR..	5s	1935	100	n 99½ n101
Manila Elec.....	7s	1942	102	102 102
Manila Elec. Ry. & Ltg..	5s	1953	91	89½ 91
Manitoba Pwr.....	7s	1941	104	103 105
Memphis Pwr. & Lt.....	5s	1948	99	n 95 n 99
Metropolitan Edison.....	6s	1952	105	104 106
Metropolitan Edison.....	5s	1953	97	96 97
Metropolitan Pwr.....	6s	1953	103	102 103
Michigan Lt.....	5s	1946	99	n 97 n100
Michigan No. Pwr.....	5s	1941	98	n 95 n 99
Milwaukee El. Ry. & Lt..	5s	1926	99	99 99
Milwaukee El. Ry. & Lt..	4½s	1931	98	98 99
Milwaukee El. Ry. & Lt..	5s	1951	99	98 99
Milwaukee El. Ry. & Lt..	5s	1961	93	90 93
Milwaukee El. Ry. & Lt..	6s	1953	103	100 104
Minn. Pwr. & Lt.....	5s	1955	95	n 95 n 97
Minn. Pwr. & Lt.....	6s	1950	104	n101 n105
Miss. Power.....	5s	1955	92	n 91 n 93
Miss. River Pwr.....	5s	1951	k 99	....
Miss River Pwr.....	7s	1935	102	n102 n104
Mo. Edison Elec.....	5s	1927	m 99	n 99 n100
Mobile Elec.....	5s	1946	k 98	....
Monongahela W. Pa. Pub. Service.....	5½s	1953	95	n 95 n 97
Montana Pwr.....	5s	1943	100	99 101
Montgomery Lt. & W.P..	5s	1943	m 93	n 86 n 93
Montreal Lt., Ht. & Pwr.	4½s	1932	97	n 97 n 98
Montreal Lt., Ht. & Pwr.	5s	1933	99	n 98 n101
Montreal Pub. Serv.....	5s	1942	94	n 89 n 94
Mountain States Pwr.....	6s	1938	99	n96 n100
NASHVILLE RY. & LT.	5s	1953	97	n 94 n 99
Nashville Ry. & Lt.....	5s	1958	91	n 84 n 92
Nassau Lt. & Pwr.....	5s	1927	99	n 98 n101
Nassau & Suffolk Ltg.....	5s	1945	90	n 82 n 91
National Elec. Power.....	6s	1945	93	n 92 n 97
National Pwr. & Lt.....	7s	1972	k102	....
National Pub. Serv.....	6½s	1955	93	n 94 n 97
Nebraska Pwr.....	5s	1949	99	n 97 n100
Nebraska Pwr.....	6s	2022	94	n 89 n 97
Nevada-Calif. Elec.....	6s	1946	k 99	....
Nevada-Calif. Elec.....	6s	1950	98	n 96 n100
New Brunswick Pwr.....	5s	1937	82	n 81 n 82
New England Pwr.....	5s	1951	101	n100 n103
New Jersey Pwr. & Lt....	5s	1936	97	n 92 n 97
New Orleans Pub. Serv...	4½s	1935	87	n 83 n 88
New Orleans Pub. Serv...	5s	1952	92	90 93
New Orleans Pub. Serv...	5s	1955	92	90 92
New Orleans Pub. Serv...	6s	1949	90	n 86 n 93
N.Y. & Queens El. L.&P..	5s	1930	103	100 103
N.Y. & Westchester Ltg..	4s	2004	80	n 76 n 81
N.Y. & Westchester Ltg..	5s	1954	97	n 93 n98
New York Edison.....	6½s	1941	115	115 116
New York Edison.....	5s	1944	103	102 103
N.Y. Gas & El. L., H.&P.	5s	1948	104	104 104
N.Y. Gas & El. L., H.&P.	4s	1949	90	89 90
N.Y. State Gas & Elec...	5½s	1962	100	n 96 n101
Newport News & Hampton Ry., Gas & Elec....	5s	1944	89	n 84 n 93
Niagara Falls Pwr.....	5s	1932	101	101 102
Niagara Falls Pwr.....	6s	1932	106	105 106
Niagara Falls Pwr.....	6s	1950	105	n105 n106
Niagara, Lock. & Ont. Pwr.	5s	1954	m 98	n104 n110
Niagara, Lock. & Ont. Pwr.	5s	1955	99	99 100
Niagara, Lock. & Ont. Pwr.	6s	1958	m109	n104 n110
Norfolk Ry. & Lt.....	5s	1949	95	n 93 n 96
No. Amer. Edison.....	6s	1952	k103	....
No. Amer. Edison.....	6½s	1948	105	103 106
No. Amer. Lt. & Pwr.....	7s	1954	99	n 97 n100
North Caro. Pub. Serv....	5s	1934	k 92	....
North Caro. Pub. Serv....	6s	1954	94	n 91 n 96
North Caro. Pub. Serv....	6½s	1944	99	n 96 n100
North Shore Elec.....	5s	1940	99	n 97 n100
No. Calif. Pwr.....	5s	1948	100	n 98 n100
No. Ind. Gas & Elec.....	5s	1929	99	n 97 n100
No. Ind. Gas & Elec.....	6s	1952	103	n 99 n103
Northern N. Y. Utilities..	5½s	1949	100	n 96 n100
No. Ohio Pwr.....	7s	1935	k 96	....
No. Ohio Trac. & Lt.....	4s	1933	87	n 82 n 87
No. Ohio Trac. & Lt.....	5s	1950	e33	n 78 n 87
No. Ohio Trac. & Lt.....	6s	1926	99	n 98 n100
No. Ohio Trac. & Lt.....	6s	1947	95	92 95
No. Ontario Lt. & Pwr...	6s	1931	m100	n 95 n100
No. States Pwr.....	6½s	1933	e 124	123 131
No. States Pwr. (notes)....	6½s	1933	103	103 104
No. States Pwr.....	6s	1948	k103	....
No. States Pwr.....	6s	1941	k105	....
No. States Pwr.....	5s	1941	k 98	....
No. Tex. Elec.....	5s	1940	70	n 72 n 82
Northwestern Elec.....	6s	1935	102	n101 n102
Northwestern Pub. Serv..	6½s	1948	99	n 97 n100
Nova Scotia Tr. & Pwr...	5s	1946	88	n 84 n 89
OHIO PWR.....	5s	1952	k 94	94 95
Ohio Pwr.....	6s	1953	103	n101 n104
Ohio Pwr.....	6s	2024	95	n 88 n 95
Ohio Pwr.....	7s	1951	105	n105 n107
Ohio Pub. Serv.....	5s	1954	92	n 87 n 93
Ohio Pub-Serv.....	6s	1953	100	n 99 n101
Ohio Pub. Serv.....	7½s	1946	112	102 113
Ohio Pub. Serv.....	7s	1947	110	110 111
Ohio River Edison.....	6s	1948	103	102 103
Okla. Gas & Elec.....	5s	1950	92	n 91 n 95
Okla. Gas & Elec.....	6s	1940	95	n 95 n 98
Ontario Pwr. of Niagara Falls.....	5s	1943	101	99 101
Ontario Transmission.....	5s	1945	99	99 99
Ozark Pwr. & Wtr.....	5s	1952	76	n 75 n 79
PACIFIC COAST PWR..	5s	1940	99	n 98 n100
Pacific Gas & Elec.....	5s	1942	k 98	....
Pacific Gas & Elec.....	5s	1955	m 93	n 94 n 95
Pacific Gas & Elec.....	5½s	1952	k102	....
Pacific Gas & Elec.....	6s	1941	k106	....
Pacific Lt. & Pwr.....	5s	1942	k100	....
Pacific Lt. & Pwr.....	5s	1951	100	98 100
Pacific Pwr. & Lt.....	5s	1930	k 99	....
Pacific Pwr. & Lt.....	5s	1953	m 96	....
Parr Shoals Pwr.....	5s	1952	96	n 92 n 97
Paterson & Passaic G.&E.	5s	1949	100	100 100
Penn Central Lt. & Pwr...	6s	1953	103	n102 n104
Penn Edison.....	5s	1946	97	n 93 n 97
Penn Elec.....	6½s	1954	96	n 96 n 99
Penn. Elec.....	6s	1955	92	n 91 n 95
Penn.-Ohio Edison.....	6s	1950	k105	98 106
Penn Ohio Elec.....	6½s	1938	107	n 99 n106
Penn Ohio Pwr. & Lt.....	5½s	1954	k 99	....
Penn Ohio Pwr. & Lt.....	6s	1939	97	n 94 n 99
Penn Pwr. & Lt.....	5s	1952	98	98 99
Penn Pwr. & Lt.....	5s	1953	98	98 99
Penn Pwr. & Lt.....	6s	1953	104	n102 n105
Penn Pwr. & Lt.....	7s	1951	105	n105 n107
Penn Pub. Serv.....	5s	1954	95	n 93 n 96
Penn Pub. Serv.....	6s	1947	104	n103 n105
Penn Wtr. & Pwr.....	5s	1940	102	n 99 n102
Penn Wtr. & Pwr.....	5½s	1953	102	n100 n103
Phila. Co.....	6s	1944	104	103 104
Phila. Co.....	5½s	1938	100	98 100
Phila. Co.....	5s	1951	96	n 93 n 97
Phila. Co.....	5s	1949	m102	n 94 n104
Phila. Elec.....	5s	1966	c104	102 104
Phila. Elec.....	4s	1966	m 85	85 85
Phila. Elec.....	5s	1960	c103	102 103
Phila. Elec.....	6s	1941	c108	107 108
Phila. Elec.....	5½s	1947	107	107 107
Phila. Elec.....	5½s	1953	c107	106 107
Portland Elec. Pwr.....	6s	1947	99	99 100
Portland Gen. Elec.....	5s	1935	101	99 100
Portland Ry., Lt. & Pwr..	5s	1942	92	88 92
Portland Ry., Lt. & Pwr..	6s	1947	99	99 100
Portland Ry., Lt. & Pwr..	7½s	1946	107	106 108
Potomac Edison.....	6s	1949	99	n 96 n100
Potomac Edison.....	6½s	1948	103	n 99 n104
Potomac Elec. Pwr.....	5s	1929	f100	....
Potomac Elec. Pwr.....	5s	1936	f100	....
Potomac Elec. Pwr.....	6s	1953	f107	....
Potomac Elec. Pwr.....	7s	1941	f107	....
Power Corp. of N. Y.....	6s	1942	101	n 97 n101
Power Corp. of N. Y.....	6½s	1942	104	n101 n105
Power Securities.....	6s	1949	k 77	....
Pub. Lt. & Pwr.....	5s	1945	69	n 64 n 79
Pub. Serv. Co. of Colo....	5½s	1954	94	n 92 n 96
Pub. Serv. Co. of Colo....	6s	1953	99	n 98 n101
Pub. Serv. Co. of Colo....	7s	1933	101	n 98 n102
Pub. Serv. Corp. of N.J..	5s	1959	105	104 105
Pub. Serv. Corp. of N.J..	6s	1944	100	100 101
Pub. Serv. Co. of No. Ill..	5s	1956	98	n 91 n 98
Pub. Serv. Co. of No. Ill..	5½s	1962	102	n 96 n102
Pub. Serv. Co. of No. Ill..	5½s	1964	102	n 96 n102
Pub. Serv. Co. of Okla....	6s	1949	99	n 97 n101
Pub. Serv. Elec. & Gas..	5½s	1959	104	103 105
Pub. Serv. Elec. & Gas ..	5½s	1964	104	n103 105
Pub. Util. Evansville, (Ind.)	6s	1929	100	n 99 n101
Puget Sound Pwr.....	5s	1933	98	n 98 n100
Puget Sound Pwr. & Lt...	5½s	1949	100	n 96 n100
QUEBEC PWR.....	6s	1953	102	n 98 n102
Queensborough Gas & E..	5s	1952	99	n 96 n100
Queensborough Gas & E..	6s	1953	104	n101 n105
RHINE-WESTPHALIA ELECTRIC PWR.....	7s	1950	k 94	93 95
Rio de Janeiro Tram., Lt. & Pwr.....	5s	1935	94	n 85 n 94
Robbins & Myers.....	7s	1952	63	61 63
Rochester Gas & Elec....	5½s	1948	105	105 106
Rochester Gas & Elec....	7s	1946	113	112 114
Rochester Ry. & Lt.....	5s	1954	100	n 99 n101
Rockford Elec.....	5s	1939	99	n 98 n101
ST. MAURICE PWR...	6½s	1953	108	n107 n109
St. Paul Gas Lt.....	5s	1944	100	n 98 n101
St. Paul Gas Lt.....	5½s	1954	101	n 98 n102
St. Joseph Ry., Lt., H.&P.	5s	1937	93	91 97
Salt River Valley Wtr....	6s	1938	k100	....
Salmon River Pwr.....	5s	1952	100	n 98 n101
San Antonio Gas & Elec..	5s	1949	96	n 96 n 98
San Antonio Pub. Serv...	6s	1952	102	101 102
San Diego Cons. G.&E....	5s	1939	100	n 98 n101
San Diego Cons.G.&E....	6s	1939	101	n 99 n103
San Joaquin Lt. & Pwr...	5s	1945	98	n 98 n100
San Joaquin Lt. & Pwr...	6s	1950	102	n101 n103
San Joaquin Lt. & Pwr...	6s	1952	101	n 99 n103
San Joaquin Lt. & Pwr...	6s	1954	101	n 99 n101
Sauda Falls.....	5s	1955	k 94	94 95
Savannah Elec. & Pwr....	7½s	1941	k104	....
Scranton Electric.....	5s	1937	101	n 99 n102
Seattle Elec.....	5s	1930	100	n 99 n101
Seattle Elec.....	5s	1929	99	n 99 n100
Seattle Elec.....	5s	1939	92	n 90 n 93
Seattle Ltg.....	5s	1949	91	n 85 n 93
Shawinigan Wtr. & Pwr..	5s	1934	100	n100 n101
Shawinigan Wtr. & Pwr..	5½s	1950	104	n101 n104
Shawinigan Wtr. & Pwr..	6s	1950	105	n104 n106
Sheboygan Elec.....	5s	1946	95	n 94 n 97
Siemens & Halske.....	7s	1928	k 98	96 99
Siemens & Halske.....	7s	1935	95	93 95
Sierra & San Fran. Pwr...	5s	1949	k 77	....
Sierra & San Fran. Pwr....	6s	1949	90	n 87 n 93
Sioux City Gas & Elec....	6s	1947	102	n 99 n102
Sioux City Gas & Elec....	6s	1949	102	n 99 n102
So. Caro. Gas & Elec.....	6s	1942	84	n 87 n 93
So. Caro. Gas & Elec.....	6s	1932	75	n 78 n 88
Southeast Pwr. & Lt.....	6s	2025	91	n 88 n 92
So. Cal. Edison.....	5s	1939	k 99	....
So. Cal. Edison.....	5s	1944	97	n 92 n 97
So. Cal. Edison.....	5½s	1944	101	n 98 n102
So. Cal. Edison.....	6s	1943	102	n100 n104
So. Cal. Edison.....	6s	1944	k105	....
So. Cities Utilities.....	8s	1931	98	n 99 n102
Southern Colo. Power....	6s	1947	k 98	....
So. Ind. Gas & Elec.....	6s	1947	k97	....
Southern Pwr.....	5s	1930	100	n 99 n101
So. Public Utilities.....	5s	1943	99	n 97 n100
So. Sierras Pwr.....	6s	1936	102	n102 n104
So. Utilities.....	6s	1933	m102	n 97 n102
So. Wisconsin Pwr.....	5s	1938	91	n 88 n 93
Southwestern Gas & E....	5s	1932	96	n 94 n 98
Southwestern Gas & E....	6s	1957	97	n 89 n 98
Southwestern Lt. & Pwr..	6s	1937	97	n 94 n 99
Southwestern Power.....	6s	1944	96	n 96 n 98
Southwestern Pwr. & Lt..	5s	1943	94	n 90 n 97
Southwestern Pwr. & Lt..	6s	2022	92	n 88 n 94
Southwestern Pub. Serv..	6s	1945	94	n 94 n 99
Southwestern Utilities....	8s	1936	95	n 96 n102
Springfield Ry. & Lt.....	5s	1926	99	n 98 n100
Standard Elec. of Cal....	5s	1939	98	n 98 n100
Standard Gas & Elec.....	6s	1935	k 99	....
Staten Island Edison.....	6½s	1953	106	n104 n107
Superior Water, Lt. & Pwr.	4s	1931	94	n 93 n 95
Syracuse Ltg.....	5s	1951	100	100 100
Syracuse Ltg.....	5½s	1954	103	n100 n103
TAMPA ELEC.....	5s	1933	k 99	....
Tenn. Elec. Pwr.....	6s	1947	103	102 104
Tenn. Pwr.....	5s	1962	95	n 90 n 96
Tex. Pwr. & Lt.....	5s	1937	98	n 97 n 99
Tex. Pwr. & Lt.....	6s	2022	94	n 90 n 97
Tide Water Pwr.....	6s	1942	99	n 98 n101
Tide Water Pwr.....	7s	1937	99	n 97 n101
Toho Elec. Pwr. (Japan)..	7s	1955	m 90	n 87 n 91
Tokyo Elec. (Japan).....	6s	1928	97	97 97
Toledo Edison.....	5s	1947	99	n 97 n100
Toledo Edison.....	7s	1941	109	108 109
Toledo Gas, Elec. & Htg.	5s	1935	98	n 97 n100
Toledo Tr., L.&P. (notes)	5½s	1930	98	98 99
Topeka Edison.....	5s	1930	99	n 97 n100
Topeka Ry. & Lt.....	5s	1933	94	n 90 n 96
Trenton Gas & Elec.....	5s	1949	100	100 100
Tri-City Ry. & Lt.....	5s	1930	k 98	....
Twin State Gas & Elec...	5s	1953	95	n 84 n 94
Twin State Gas & Elec...	5½s	1945	97	n 96 n 98
Tyrol Hydro-Elec. Pwr...	7½s	1955	m 96	n 94 n 97
UJIGAWA ELEC PWR.	7s	1945	91	n 90 n 92
Union Elec. Lt. & Pwr...	5s	1932	100	100 101
Union Elec. Lt. & Pwr...	5s	1933	100	100 100
Union Elec. Lt. & Pwr...	5s	1954	99	n 97 n100
Union Elec. Lt. & Pwr...	5½s	1954	101	100 102
United Elec. of N.J.....	4s	1949	87	n 85 n 89
United Elec. Lt. & Pwr...	4½s	1929	98	n 96 n100
United Gas & Elec.....	6s	1945	101	n 96 n101
United Lt. & Pwr. (notes)	5½s	1928	99	n 98 n100
United Lt. & Pwr.....	5½s	1959	96	n 90 n 97
United Lt. & Pwr.....	6½s	1974	97	n 92 n 97
United Lt. & Rys.....	5s	1932	96	n 82 n 97
United Lt. & Rys.....	6s	1926	100	n100 n101
United Lt. & Rys.....	6s	1952	99	n 95 n100
United Lt. & Rys.....	6s	1973	89	n 87 n 92
United Pwr. & Lt.....	6s	1944	101	n 99 n103
United Water, G. & E....	5s	1941	93	n 92 n 94
Utah Lt. & Trac.....	5s	1944	88	86 88
Utah Pwr. & Lt.....	5s	1944	96	95 97
Utah Pwr. & Lt.....	6s	1944	103	n102 n104
Utah Pwr. & Lt.....	6s	2022	92	n 88 n 94
Utica Elec. Lt. & Pwr....	5s	1950	101	100 101
Utica Gas & Elec.....	5s	1957	101	100 101
Utica Gas & Elec.....	5½s	1949	103	n101 n 103
VERMONT HYDRO - ELEC.....	6s	1929	100	n 98 n100
Vicksburg Lt. & Trac....	5s	1932	91	n 89 n 93
Virginian Pwr.....	5s	1942	94	n 88 n 96
Virginian Pwr.....	6½s	1954	103	n 99 n103
Virginia Ry. & Pwr.....	5s	1943	98	97 99
Virginia-Western Pwr....	6s	1953	100	n100 n101
WAGNER EL. MFG....	7s	....	m 100	100 100
Washington Coast Util...	6s	1941	101	n 99 n102
Washington Ry. & Elec...	4s	1951	f 80	....
Washington Ry. & Elec...	6s	1933	f 102	....
Washington Wtr. Pwr....	5s	1939	101	101 101
West Penn Pwr.....	5s	1963	100	99 100
West Penn Pwr.....	5s	1946	100	99 100
West Penn Pwr.....	5½s	1953	105	104 106
West Penn Pwr.....	7s	1946	105	105 106
W. Va. Lt., Ht. & Pwr....	6s	1929	102	n 95 n101
West Virginia Utilities....	6s	1935	96	n 91 n 98
W. Va. Water & Elec.....	6½s	1942	102	n100 n104
Westchester Ltg.....	5s	1950	102	102 103
Western Elec.....	5s	1944	100	100 100
Western N. Y. Utilities...	5s	1946	96	n 90 n 97
Western Pwr.....	6½s	1954	100	n 97 n101
Western Pub. Service.....	6s	1950	97	n 96 n 98
West States Gas & Elec..	5s	1941	98	n 95 n 99
West States G.&E. (notes)	6s	1937	94	n 94 n 97
West States Gas & Elec..	6s	1947	k 99	....
West United Gas & El....	5s	1950	100	n 97 n101
West United Gas & El....	6s	1950	101	n100 n102
Westphalia Un. Elec. Pwr	6½s	1950	m 87	n 87 n 97
Westinghouse El. & Mfg.	7s	1931	106	105 106
Wheeling Elec.....	5s	1941	97	n 96 n 99
Wichita R. R. & Lt.....	5s	1932	84	n 83 n 88
Winnipeg Elec.....	6s	1954	95	n 94 n 97
Wisconsin Elec. Pwr.....	5s	1954	98	n 93 n 99
Wisconsin Gas & Elec....	5s	1952	k 99	....
Wis.-Minn. Lt. & Pwr....	5s	1944	k 95	....
Wisconsin Pwr., Lt. & Ht	5s	1946	92	n 87 n 93
Wisconsin Pub. Service...	6s	1952	101	n 99 n102
Wis. Ry., Lt. & Pwr.....	5s	1933	92	n 87 n 93
Wis. River Pwr.....	5s	1941	91	n 88 n 92
Wolverine Pwr.....	7s	1943	100	n 99 n101
YADKIN RIVER PR..	5s	1941	k 99	....
Yarmouth Lt. & Pwr.....	5s	1937	83	n 82 n 87
Yarmouth Lt. & Pwr.....	8s	1951	99	n 97 n102

Stock Exchange: *c*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Tuesday, Feb. 2. *l*Bid, low, high, Wednesday, Feb. 3. *m*Latest quotations available, *n*1925.

Manufacturing and Markets

Refrigerator Manufacturers Adopt Program

Co-operative Market Development to Be Undertaken with Aid of Society for Electrical Development

A GROUP of the leading manufacturers of electrical refrigerators met at the Westchester-Biltmore Country Club, Rye, N. Y., Jan. 28, 29 and 30, in the third of a series of meetings called for the purpose of considering the possibilities of co-operative activities which would benefit the industry as a whole. Representatives of the following companies attended the meeting: The Copeland Products Company, the Delco-Light Company (manufacturer of Frigidaire), the General Electric Company, the Kelvinator Corporation, Nizer Corporation and Servel Corporation.

Definite action was taken approving a $100,000 co-operative, market-development program which will be carried forward during the coming year by the Society for Electrical Development. Steps were also taken looking toward the formation of a permanent organization to be known as the Electric Refrigeration Council. The movement to organize this new group in the industry was originally started by J. Robert Crouse, who called together a group for an informal meeting at Waldenwoods, Mich., in May, 1925.

Plan to Co-ordinate Functions

A feature of the plan to organize the refrigerator manufacturers has been the bringing together of the sales, production, advertising and service managers and other department heads, in addition to the executives of the companies, and the grouping of the men representing each of these functions constitute committees to work out constructive plans for the progress of the industry. This method of approaching the problem is proving most successful and is already suggesting a model which might be followed by other groups in working out co-operative programs.

The educational and market-development program presented by the Society for Electrical Development calls for a series of full-page advertisements in the *Saturday Evening Post* starting in May, 1926, which will be co-ordinated with the advertising of the individual companies. In these advertisements the society will present to the public, over its own signature, the broad advantages and benefits of electrical refrigeration in relation to food preservation, convenience, economy and home comfort in general. The program also calls for the production of neutral, educational literature suitable for the use of central-station companies and others who are primarily interested in selling the idea of electrical refrigeration rather than a particular make of machine.

Another important feature of the plan will be the appropriation of $10,000 for carrying on experiments to determine scientific facts about the preservation of food. These experiments will be made by some well-known scientist connected with one of the great universities of the country. The results of this research will be made available to household science departments of schools, home study clubs and the public in general. While the meetings so far have been largely for the purpose of getting acquainted and bringing about good feeling and a constructive attitude in the industry, the group is now looking to the formation of a permanent organization to carry forward the ideas and plans which have been suggested. It will be the aim of the council to foster a spirit of friendly co-operation, both nationally and locally.

E. G. Biechler, president of the Delco-Light Company, has been elected president of the temporary organization, with an executive committee as follows: W. R. Wilson, president Copeland Products Company; C. W. Stone, manager central station department General Electric Company; A. H. Goss, president Kelvinator Corporation; O. A. Glasebrooke, Jr., vice-president Nizer Corporation; H. G. Scott, chairman of the board Servel Corporation, and F. M. Cockrell of the Society for Electrical Development, who has been made secretary of the committee.

What the Industry Thinks of Inspectors*

Now Apart from Industry, but Could Be Made a Great Constructive Influence for Progress—Lack of Uniform Inspection a Burden—Suggestions Made

By Earl E. Whitehorne
Commercial Editor Electrical World

A VERY prominent official of one of the electrical inspectors' associations has frankly asked this question, What does the electrical industry think of the electrical inspector? I am going to answer in the same frank spirit and set down plainly what I find to be the feeling among electrical men. In a word, the electrical industry does not think about the electrical inspector at all. It looks upon the inspector as something quite apart from the electrical industry. And it regards this great body of men in the light of an unorganized police force, that undoubtedly contributes to safety in the use of electricity, but, instead of keeping order, promotes disorder because it is unorganized. But electrical men who have considered the subject at all from the national and industry standpoint believe that the inspector could be made a great constructive influence for progress, and they are disappointed because he is not.

There is no question as to the industry's need of inspectors. All men recognize the vital importance of having an established code to guide the installation of electrical wiring equipment. Therefore, there must be an inspection service to insure the observance of the code. But the electrical men believe that this inspection service should be an active, co-ordinated function of the electrical industry, that the inspector should be something more than a policeman.

Purposes of Inspection

In my opinion the fault lies not in either the intent or the ability of the inspector. No man can criticise the sincerity of these men or their capacity for work. Rather the trouble comes from too limited an objective, too narrow a vision of the purposes of inspection. For both the inspector and the electrical industry have overlooked the fact that there are two very fundamental reasons both for a code and for inspection.

The prevailing belief is that the sole job of the inspector is to make wiring installations safe. Of course this was the first idea. That is why the fire underwriters first organized an inspection service. These men were told to prevent fire hazards, and they have done a faithful job, as thorough a job as they were able to, in keeping the code safe. But prevention being their responsibility they have naturally leaned over backward and too far, and taken an attitude of prohibition, so that electrical men have come to feel that development and progress in the code can only be achieved through overcoming the opposition of the insurance interests and the inspectors. And being so closely focused on this work of making electrical installations safe, the inspectors have almost entirely overlooked the fact that they have another responsibility of no whit less importance—to make electric installations economical.

Economic Influence

There is just as great an economic value in a code and inspection service as in its value for the promotion of safety. The economic value of a code and inspection service comes through its influence for the standardization of manufactured products and reduces the amount of duplication and the excess varieties of types and sizes that must be manufactured, distributed, stocked and sold. This means, of course, production in larger quantities and at

*From an address before the Western Association of Electrical Inspectors, Chicago, Jan. 28, 1926.

lower costs. It also means convenience to the public because any lamp will fit any socket and because an appliance may be taken from one house to another and used. It means that men who buy material when they place an order know what they are going to get. It makes it possible for men who install wiring to use material from many sources on the same job, because every manufacturer's product is not dissimilar from every other make. And without a large measure of such standardization the great development of the electrical industry would not have been possible.

RESPONSIBILITY FOR SAVING

But the inspectors, in their earnest pursuit of safety, have forgotten this economic responsibility that rests upon them. They have not taken any active part in helping to keep the manufacture, distribution and installation of electrical products simple as well as safe, from the national and industry viewpoint. And yet I believe that the inspector might have been and may still make himself an outstanding leader in this constructive work.

The great weakness of the inspector today, it seems to me, is this lack of national co-ordination and responsibility. It is perfectly natural that men's opinions should differ as to whether this method of construction or that material is safest. But it is not possible to maintain an orderly and progressive industry if we permit the fundamental regulation of electrical construction to be arranged in each community to suit the local preference and prejudice, any more than you could maintain an orderly federal government and leave the national laws to be adopted and applied as any community might desire.

COSTLY CONFUSION

And, furthermore, it is not necessary —for what is safe in Ashtabula is safe in Oklahoma City. True, conditions differ in different kinds of towns, but under given conditions an electric circuit can be constructed the same way in Seattle or Sioux City, Savannah or Syracuse, and be equally secure. And yet today the rules of the electrical inspector may differ with the landscape or the locality. Consider the safety switch, that much-quoted example of inspection inconsistency. It is an iron box inclosing a switch and fuse—same kind of iron, same kind of copper, same kind of electric current, same sort of human being to handle it. Yet in one place to be officially safe the cover must be hinged at the left, while another state requires hinges at the right, while still another insists on top hinges, and a fourth locality forbids all hinges and demands set screws. A prominent jobber told me once that he was compelled to carry in stock six different varieties of one size of safety service entrance switch to meet the inspection requirements of various cities within the territory he serves. Think of the burden of extra stocks that this entails all along the line and the extra jigs and patterns back in the factory and what it costs.

In a word, the result of this present lack of inspection uniformity in the electrical industry causes a considerable degree of economic pandemonium. The inspector has been saving the public millions of dollars through reduced fire loss, but he has been causing the waste of other millions quite as valuable and as savable by lack of simplicity and uniformity in regulations that have resulted in endless duplication and excess varieties of manufactured products. The reason is that whereas the inspector has been taught his responsibility for safety, he has not been charged with his economic responsibility and he has not been interested in it. But he can be interested in it, and when he is he will render a great service to the electrical industry and to the American people and open up a great opportunity for himself.

That, I find, is about what the electrical industry thinks of the electrical inspector, with whom it has as yet had so little in common. But I am not willing to let the subject rest right here with criticism and no suggestions. I am going to tell you what I think you ought to do. If I were king of the electrical inspectors of America, I'll tell you what I think I'd do first thing. I'd call a great convention of inspectors —have them all there in a great hall— in Chicago or New York—and I would lead on the stage a policeman from the nearest corner. I would say to these inspectors: "Look at this man and consider the case of the 'cop'—how he has changed in the public estimation in recent years. There was a time when a policeman's sole idea was to watch for people who were breaking laws. 'Cheese it, the cop!' expressed the prevailing public sentiment. He represented the power of government and worked purely by interference. Then came traffic, and the policeman took his place upon the crossing to help and not to hinder, and presto! the whole public psychology toward the cop has changed—because the spirit of the officer himself changed once he was given something helpful and friendly to do."

WHAT THE INDUSTRY ASKS

No one could ask that electrical inspectors should be any finer type of men than they are now today, or say that they must have higher principles, but the electrical industry does ask this:

First—That they get a new slant on service.

Second—That they become helpful to the public as well as protective.

Third—That they become something more than the watchdog of electric wiring.

Fourth—That they stop being an offshoot of the insurance business or merely a department of municipal government and organize as one of the great functional branches of the electrical industry, with a progressive program and a constructive purpose.

Fifth—That they co-operate with the other branches of the electrical industry to keep order in electrical construction from the national standpoint and assist in developing the art as well as preserving safety.

And again I think you will say, "All right—but how are we to set about it?" Well, I think if I were king of the electrical inspectors in America, I would set up these eight objectives and work for them—and I submit them to you for your consideration:

ORGANIZE NATIONALLY

First—Organize into a national association of electrical inspectors to tie together all groups and build a national consciousness for the inspector and win for yourselves a position of recognized influence and leadership in the electrical industry.

Second—Become a progressive and creative factor in the development of the code, suggesting improvements whenever the possibility appears, working conspicuously for simplicity, for flexibility and for economy as well as for safety.

Third—Become the organized champion of orderly procedure in the evolution of the code through the approval of new products and the revision of the rules.

Fourth—Get behind the uniform ordinance that has been developed by the Electrical Manufacturers' Council and work for its adoption in all cities as a practical means of securing uniformity of inspection throughout the land. Here is a great economic contribution which the inspector can make to the American people.

Fifth—Work for tolerance and common sense in the interpretation of the code. Make it the consistent national policy of the inspectors that if two rules are applicable the broader should govern, since both are safe. Establish an ideal of helpfulness in inspecting rather than the spirit of prohibition and autocratic authority that is too often encountered.

Sixth—Take leadership in the encouragement of adequacy in wiring installations, by suggesting to the contractors the benefits that come from more satisfying installations. I think that the inspectors should be out-and-out advocates of the "Red Seal" plan and active supporters of the local league in every community.

Seventh—Wield a guiding influence to keep down the cost of electrical installations by discovering, developing, and promoting possibilities for economies both in methods and material.

Eighth—Become the recognized authority on electrical safety. The inspector, being neutral, is the one man who can speak of electrical safety with complete acceptance locally. He should promote public confidence in electricity as much by teaching the public to make their wiring installations safe as by policing the work of their electrical industry.

There has been long-continued controversy among electrical men over the procedure that should be followed in admitting new products for use in electric wiring. The issues involved in this whole question involve many technicalities and traditions, and the average man is apt to be a bit bewildered. It seems to me, however, that under it all stand out these four principles to which any fair mind will subscribe:

1. The National Electrical Code and the National Electrical Safety Code, having been established as American

standards under the regulation of the American Engineering Standards Committee, are no longer merely the instruments of the fire insurance underwriters nor the property of the electrical manufacturers, the contractors or the inspectors. Their function is neither to defend established products nor yet to restrict or assist new products, but solely to provide and maintain adequate protection for the American public in step with the advancing art.

2. The testing of new materials as acceptable in these codes should be from the sole standpoint of determining the fire or casualty hazard involved in their use when the material is installed in accordance with the code.

3. Specifications for such test should deal with the purpose and the methods of the test, but not with the construction of the material, the issue being not its structure, but its safety and dependability in the performance of its function.

4. New materials should be approached, not for the purpose of proving them good or bad, right or wrong, but by an orderly procedure to determine their fitness for admission for use under the code.

If these four principles were clearly understood and universally accepted, there could be little basis for disagreement over new products. Men would naturally withhold judgment until proper tests were made and then abide by the results. And I believe that the inspectors can bring a helpful guidance here. If the electrical inspectors will unite and do these things and render the continuing services that will naturally suggest themselves, nobody will ever have to ask again what the electrical industry thinks of the inspector. The electrical industry will then be very conscious of the influence and importance of the inspector—and so will the American people.

California Corporation to Finance Sales of Appliances

For the purpose of financing the installment sale of electrical and gas appliances by dealers and the merchandising departments of the public utility companies, interests identified with the Southern California Edison Company have organized the Southwestern Acceptance Corporation, a Delaware corporation, with an authorized capital of $2,000,000, consisting of 360,000 shares of 7 per cent cumulative preferred stock and 40,000 shares of common stock, both having a par value of $5. The new company will discount the installment contracts on appliances sold to consumers throughout southern California by appliance dealers and the Southern California Edison Company. The particular function of the company is to promote the sale of electrical appliances, including refrigerators, ranges, water heaters, ironers, vacuum sweepers and air heaters. Many dealers, it is explained, are unable to stimulate sales of electrical appliances by the installment method because of lack of capital. The acceptance corporation is designed to supply this deficiency.

With the exception of Norman L. MacLeod, the president of the acceptance corporation, all the directors are affiliated with the Edison company. They are: John B. Miller, R. H. Ballard, S. M. Kennedy, Ben M. Maddox and Mr. MacLeod. The officers, in addition to the president, are: S. M. Kennedy, vice-president; Byron Fluno, secretary, and E. G. Miller, treasurer.

Use of Creosoted Pine Poles Shows Increase

The use of pressure-creosoted pine poles in 1924 showed an increase of nearly 100 per cent over the 1923 figures, according to the service bureau of the American Wood Preservers' Association. The following statistics, covering pressure-creosoted pine poles for each of the last eight years, have been compiled by the United States Forest Service in co-operation with the above association:

Year	No. of Pine Poles Pressure-Treated
1917	103,804
1918	67,541
1919	156,346
1920	167,289
1921	224,777
1922	291,991
1923	451,852
1924	899,201

Figures on creosoted pine poles as a separate class have never before been given out.

Business Conditions

THE report of the unprecedented volume of power-company financing recorded in January is a strong note in the electrical business situation this week. More than $168,000,000 was raised by the central-station companies in the money markets as compared with $83,000,000 in January of last year—an achievement which presages large buying of electrical materials and equipment in the months to come. The first six months of this year are expected to show better volume of sales than the same period in 1925. Failures for January were 11.4 per cent less than for that month last year.

The electrical market in general is strong this week. Increased volume of sales are reported from Boston, Atlanta, Chicago and San Francisco for the territories served through those centers. Ample rain, with snow in the mountains, has brought added confidence to the Pacific Coast that there will be no power shortage this year. Power-company buying there is heavy. Farm-lighting plants have shown a notable increase in sales in the Northern Central States, and there is unusual building activity in the Middle West, with much utility construction work in process. The New York district shows little change this week. Industrial buying is active and there have been sizable orders for meters and transformers from municipalities. In the Southeastern States jobbers are running well ahead of last year and industrial business is also on the increase. Florida continues to provide an active and extensive market. In New England sales of supplies and equipment are generally larger than in 1925. Motors, ranges, insulators and light lines are strong. Transformers and meters are quiet. There are many inquiries for heavy station equipment.

Better Tone in Metal Markets —Copper Up

PRICES of copper, zinc and tin improved somewhat this week, although the volume of business has not been particularly impressive. Lead has held steady. European conditions are on the mend and London prices are a bit higher. The demand for copper has increased and sales have been well above last week. On Thursday, Friday and Saturday there were many sales under 14 cents for Connecticut and nearby deliveries. By Monday, however, sales were priced 14 cents or better, and by Wednesday the level stood at 14¼ cents. Business in the Middle West was better than usual. Sentiment in the copper market has distinctly improved.

Sales of zinc have been fairly good at 8 cents and slightly above, although galvanizers have been buying in small lots and for early delivery. The lead market is stronger in the Middle West than in New York, and the volume of business has not been large. The American Smelting & Refining Company has continued its official price at 9.25 cents, New York. The disparity between European and American markets continues to be wide, so that foreign ore lead is most advantageously brought to this country.

NEW YORK METAL MARKET PRICES

	Jan. 27, 1926 Cents per Pound	Feb. 3, 1926 Cents per Pound
Copper, electrolytic	13.975	14.075
Lead, Am. S. & R. price	9¼	9¼
Antimony	22½	22½
Nickel, ingot	35	35
Zinc, spot	7.95	8.35–8.425
Tin, Straits	61¼	62¼
Aluminum, 99 per cent	28	28

Base copper price Feb. 3, 1926, 16 cents

Industrial Buying Strong in New York—Jobbers Busier

CONDITIONS in the New York district show little change this week. Inquiries from central-station companies are still numerous, but no decided activity in buying has developed so far this year. The demand for pole-line material is steady and an advance in the price of poles is reported. Manufacturers of insulators and switching equipment state that sales of these materials are considerably ahead of the corresponding period last year. Conditions in the wire industry are re-

ported as steady, no outstanding features being noticeable. Industrial buying continues strong, and an increased demand for small motors for household appliances is reported by one motor manufacturer.

Jobbers report a slight improvement in the demand for building construction material. Appliance sales are slow, as is usual at this time of the year, although a slight increase in the sales of the smaller appliances is in evidence.

Good Wholesale Business in the Middle West

REPORTS of building and traffic show unusual activity in the Middle West as compared with previous years, and the volume of general business is increasing steadily. Reports emanating from agricultural implement manufacturers give a decided optimistic outlook for 1926. The various utility companies are busy with construction work and extensions of distribution lines. Considerable quantities of cable and trunks and meters are being bought, although purchasing is on a conservative basis. Maintenance purchases help materially to increase the volume of business. Considerable quantities of high-tension insulators, transformer arms and pole-line hardware were purchased this week.

Jobbers report excellent sales. Active building has led to increased sales in roughing-in material. Appliance sales are holding up well, with a particularly good demand noted for washing machines, one jobber placing an order for 250 this week.

Prices have been somewhat erratic. Strain-insulator prices advanced about 10 to 15 per cent, and it was announced that the price of high-tension insulators would advance today, although just how much the advance would be was not announced. A new price schedule of incandescent lamps was put into effect, embodying several reductions and new types of lamps. No. 14 solid single-braid wire was reduced in price approximately 6 per cent, effective for the next thirty days. This is not a general reduction, but apparently is a result of severe competition. Certain types of mechanics' rubber goods were advanced in price, such as linemen's blankets and rubber gloves.

Sales in New England Brisk with Good Outlook

AS COMPARED with January, 1925, the month ended last week showed an encouraging increase in sales of electrical supplies and equipment throughout New England. The buying tone at the present time is favorable, actual sales have increased, and the orders are heavier. One manufacturer of electric ranges reports heavy shipments of his product to the South and the Southwest, where the demand is quite strong, particularly in Florida. Electric arc welders are attracting much interest, and one manufacturer's agent reports almost doubling the volume of sales last month as compared with 1925. Small motors are maintaining an even trend, and interest is recorded for special-duty motors of large capacity. Both textile and shoe industries are becoming more active in the electrical market.

Central-station supplies are unsteady, though many negotiations are under way. Transformer and meter sales are off, insulators are strong, and one manufacturer's agent reports sales amounting to more than $140,000 for the past week. Wire, pipe and new construction supplies, while off, still show promise considering the season.

Electric lighting is active, both street and interior, and a number of large projects are pending. Illuminated street signs are in good demand, recent installations totaling a connected load of 120 kw. in two blocks. Electric truck sales are progressing. Since Nov. 1 twelve 1-ton Ward trucks have been installed by a baking company, and other sales are reported in Rhode Island.

Much equipment will be purchased for this district soon. One central-station company is considering the purchase of 3,000 kva. in static condensers for subdivided application; several important projects involving turbo-generators are about to mature, and new construction promises a high level of sales of construction supplies and equipment. In general the jobbing trade is quite steady; radio sales are holding up well, collections are fair, and business appears to be running along satisfactorily.

Line Materials Active in Southeast —Wiring Quiet

ACTIVITIES in electrical jobbing lines for January were very satisfactory in the Southeastern section, and the volume of sales shows an increase over the same month last year. There is an unusual amount of line construction for this period of the year, particularly transmission-line building in south Georgia, Florida and Alabama, and this is reflected in the activity of creosoted poles, cross-arms and pole-line hardware. Line tools are also reported as moving satisfactorily. Municipalities are buying more generously of line materials, and a reasonable number of orders for house-type meters and distribution transformers are also reported from this class of purchaser.

Wiring devices generally have been rather quiet for the past ten days, in both the lighter and the heavier classes, but inquiries for quotations on industrial jobs give promise of bringing the line back into real activity in the immediate future. Industrial business generally is looking up, as is evidenced by the satisfactory increase in the sale of motors of capacities up to 100 hp. Socket devices are normal, but campaigns planned for February will considerably stimulate the movement in this line. The heavier types of socket appliances, such as washing machines and vacuum cleaners, are moving very satisfactorily, the sales total for December and January showing sharp increases over the same period the year before. Several large central-station companies are planning electric refrigerator campaigns for the immediate future, and two central stations in south Georgia have just launched kitchen-lighting and commercial-lighting fixture campaigns.

Considerable activity is evidenced in the steam-turbine field, inquiries and quotations being requested on sizes from 3,000 kva. to 25,000 kva. Fort Lauderdale, Fla., has closed a contract for two 25,000-kva. units, and other Florida cities are in the market for large units. This is quite a reversal from the period a few years ago when most of the orders from the Florida section were for turbines ranging in capacity from 500 kva. to 1,000 kva.

Radio continues very strong, with the "A" and "B" battery eliminator coming to the forefront rapidly and predictions that it will be a very fast-moving and stable article by next season.

California Contractors Busy— Coast Power Companies Buying

HEAVY rains in the valleys and several feet of snow in the mountains have given a fine tone to the electrical outlook on the Pacific Coast with its assurance against another dry year. Building is running heavy in California and is reflected in inquiries. For example, one San Francisco contractor is in the market for two carloads galvanized conduit, 50,000 lock nuts and bushings, 2,000 convenience outlets, 1,500 switches and plates, 10,000 outlet boxes and covers and one carload of rubber-covered wire.

Contractors report good business from all over the state. Country dealers in the smaller towns are apparently replenishing their stocks after a quarter of hand-to-mouth buying. Appliance lines, such as washers, vacuum cleaners and hollow ware, are quite slow. Power company purchases are reaching almost unprecedented quantities on pole-line hardware and other material for lateral line construction. Quotations are now being received on almost ten car loads of bolts and braces for central California alone, together with such items as a carload of deep-groove double-petticoat insulators and yearly contracts on insulating tape and dry batteries. Orders this week include $25,000 worth of poles, principally 10 in., 55 ft..; 20,000 lag screws, ½ in. x 4 in., and 140,000 ft. single and double galvanized guy strand, sizes ¼ in. and ½ in. Heavy machinery purchases have included three transformers, rated at 1,000 kva., 44,000 volts primary, to be used in connection with construction of Big Meadows Dam in Plumas County.

Collections slowed up materially during December, probably as a result of the increased holiday stocks and dealers' emphasis upon sales at the expense of collections. Jobbers' collections, which had averaged 45 days during the year, slowed up about five days during December. Motor sales in the Puget Sound district were the feature of January, but for the jobbers the month was an average one. Increased activity in the heavy apparatus line is foreseen during February. The city of Tacoma has opened bids for the year's requirements of meters of 5 amp., between $30,000 and $35,000 worth, and for transformers, totaling $100,000. Building permits in Seattle last month totaled five million, the largest January in the history of the city, and motor sales for ventilating and elevator equipment were heavy.

Activities of the Trade

Plate-Steel Scroll-Case Patent Suit Decided

The suit brought by the Allis-Chalmers Manufacturing Company against the Columbus Electric & Power Company and the S. Morgan Smith Company alleging infringement of the W. M. White United States patent No. 1,076,617, issued Oct. 21, 1913, has been decided in favor of the defendants. Suit was brought in the District Court of the United States for the Northern District of Georgia and was heard by Judge Sibley. The decree holds that "the court having given due consideration to the cause, it is found in accordance with the opinion filed that the patent No. 1,076,617 is valid, but not infringed." It is probable that the case will be appealed.

Moloney to Expand Facilities and Make Full Line of Transformers

Association of the Moloney Electric Company, St. Louis, with the American Brown, Boveri Electric Corporation will, it is announced by the company, result in no change in the Moloney product, either in design or electrical characteristics. However, increased manufacturing space will be provided at St. Louis and at the Camden, N. J., plant of the Brown-Boveri Company. Transformers will be built after both the Moloney and Brown-Boveri design in sizes as large as 45,000 kva. and for the highest voltages used in this country, so that a more complete line of transformers will be available to the trade.

There will be no change in the Moloney sales organization, as announced in the Nov. 28, 1925, issue of the ELECTRICAL WORLD, when it was stated that the two companies had become affiliated, except such as may be required in the regular conduct of the organization under the present management. There will also be no change in the management. The company states that within the next six months it will be able to offer to the trade a complete line of large power transformers embodying many new features.

The Automatic Electric Washer Company, Inc., Newton, Iowa, held a three-day sales convention at its factory during January at which about seventy-five of its salesmen and resale men from all parts of the country were in attendance. The convention is an annual affair, but at this particular meeting the new "model '76" automatic electric washer was officially launched.

The Simplex Wire & Cable Company, Boston, has acquired property adjoining its works on Franklin Street, Cambridge, comprising a one-and-three-story building and adjacent land.

The States Company, Hartford, Conn., has appointed the J. W. Murphy Company, 108 South La Salle Street, Chicago, sales representative for its line of meter testing and other allied apparatus including time switches, load boxes, cut-outs, etc. The Murphy company will handle these products in Illinois, Indiana and southeastern Iowa.

The Ballard Oil Burning Equipment Company, Boston, announces the removal of its offices and showrooms to 535 Commonwealth Avenue. This company specializes in automatic oil-burning equipment and electric refrigeration.

The Master Electric Company, Dayton, Ohio, motor manufacturer, held a sales conference at Dayton on Jan. 11 to 12 which was attended by the branch office representatives and distributing agents. The primary object of the conference was to acquaint the field organization with the greatly increased plant facilities offered by the new factory, at Linden and Master Avenues, into which the company recently moved.

The Fulton Iron Works Company, St. Louis, manufacturer of Diesel and steam engines, etc., in order to make adequate provision for extending terms to customers and for financing companies contemplating new factories or rehabilitating those now in operation, has caused to be organized a corporation under the laws of Delaware known as the Fulton Finance Company. The finance company is owned by the iron works company and has a paid-up capital of $500,000 and an authorized note issue of $2,500,000, of which $1,200,000 is issued and outstanding.

The Wagner Electric Corporation, St. Louis, announces the removal of its Omaha (Neb.) office to 2566 Leavenworth Street.

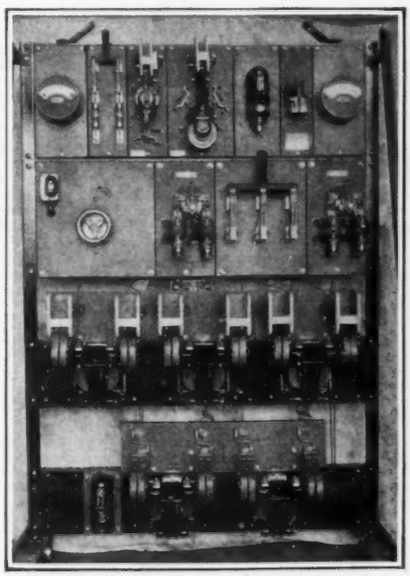
The Bates Expanded Steel Truss Company, manufacturer of Bates steel poles, steel structures and fabricated towers and substations, announces that its sales and executive offices, formerly in the Illinois Merchants' Bank Building, Chicago, are now in its new office building adjacent to the Bates plant in East Chicago, Ind.

The Strom Division of the Marlin-Rockwell Corporation announces the removal of its Philadelphia office to 1211 Franklin Trust Building, Fifteenth and Chestnut Streets.

New Equipment Available

Synchronous-Motor Control Panel

An automatic synchronous-motor control panel for driving a line of rubber mills and having a double overload protection has been developed by the Electric Controller & Manufacturing Company, Cleveland. The control board, as shown in the illustration, is



AUTOMATIC SYNCHRONOUS-MOTOR CONTROL PANEL PROVIDING DOUBLE OVERLOAD PROTECTION WHEN USED WITH A MAGNETIC CLUTCH

operated through a push-button. In the first operation a three-pole contactor connects the primary of the motor to a reduced voltage. When the current has fallen to a predetermined point a relay causes a second contactor to connect the primary of the motor directly on the full voltage of the line. A time-delay relay then closes the field circuit.

The field is kept short-circuited through a field discharge resistance during the starting process. The motor being connected to its load through a magnetic clutch can be operated as a synchronous condenser if desired. Double overload protection is provided by arranging one set of relays, set at a slightly lower value, to open the magnetic clutch circuit, and another set of relays, set at a higher value, will open the motor circuit should the overload persist.

Hollow Conductor.—The hollow conductor placed on the market by the American Brass Company, Waterbury, Conn., and described in this department in the Jan. 30 issue of the ELECTRICAL WORLD, contained an illustration of a 650,000-circ.mil conductor, which was described as being suitable for 22,000-volt operation. This conductor of 1.10-in. outside diameter should have been listed as suitable for 220,000-volt operation.

Flexible Power Units.—A power unit with a special flexible shaft operating a grinder, buffer, drill, stove brush, waxing brush, etc., for use in the machine shop as well as in the home, has been placed on the market by the Sirianni & Trumbettas Manufacturing Company, 6 Brown Street, Carbondale, Pa. The unit consists of a ¼-hp. motor and 5 ft. of flexible shaft with a 10-ft. cord extension for connecting the motor to a power supply. These motors can be disconnected and used without attachments for various purposes if desired.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Bogota, Colombia (No. 18,921), of batteries, copper wire, fuse and generator. An agency is desired in Bogota, Colombia (No. 18,969), for steam and electric excavators, dredgers, compressors, pneumatic tools and oil engines.

Purchase or agency is desired in La Paz, Bolivia (No. 18,966), for small electric batteries for pocket flashlights.

An agency is desired in Melbourne, Australia (No. 18,953), for electrical appliances, telephone accessories and supplies.

Purchase is desired in Tegucigalpa, Honduras (No. 18,922), of small portable electric polishing machines for polishing marble.

Purchase is desired in Montevideo, Uruguay (No. 18,924), of eight portable radio outfits.

Purchase is desired in Saloniki, Greece (No. 19,003), of long-distance radio sets.

Purchase is desired in Dresden, Germany (No. 18,914), of radio sets and crystals.

An agency is desired in Alexandria, Egypt (No. 18,927), for radio sets and parts. Purchase is also desired (No. 18,997) of electric player pianos.

An agency is desired in Vienna, Austria (No. 18,965), for radio sets and parts and for vacuum cleaners.

Purchase is desired in Leipzig, Germany (No. 18,964), of radio sets and parts, including loud speakers.

Sole agency is desired in Mexico City, Mexico (No. 18,926), for electric advertising novelties of all kinds, especially flashing display signs.

PANELS, OIL FILTERS, ETC., FOR ARAPUNI (NEW ZEALAND) POWER SCHEME.—Tenders will be received by the Secretary of Public Works, Supplies and Tenders Board, Wellington, New Zealand, until March 23 for five transformer and five feeder automatic oil-immersed circuit-breaker panels, two synchronous-condenser panels, etc., for the Arapuni Power Scheme, Section 123, Penrose station; four 7-12-gal.-per-minute and one 25-40-gal.-per-minute oil filter, etc., for the Arapuni Power Scheme, Section 154.

New Trade Literature

ELECTRIC MACHINERY DATA.—Bulletin No. H338, issued by Fairbanks, Morse & Company, Chicago, entitled "Electric Machinery Catechising," is designed to present in a simple way the most important theoretical and practical features of the common types of direct-current and alternating-current motors, generators and control equipment and is intended for those who are not familiar with electrical phenomena or terminology. The text in this publication is illustrated by Fairbanks-Morse machinery, and in some cases the details of the machines are discussed. A series of twelve diagrams are given showing the electric and magnetic conditions in a two-pole, three-phase motor at the end of twelve equal parts of one cycle.

INCLOSED MAGNETIC SWITCHES.—The General Electric Company, Schenectady, N. Y., is distributing bulletins GEA-181 and GEA-195, covering its "CR7006-D7" and "D9" alternating-current inclosed magnetic switches for alternating-current motors, and "CR7005-A4" inclosed magnetic switches for starting small alternating-current motors respectively.

PORTABLE BOND TESTERS.—Bulletin No. 200 issued by the Roller-Smith Company, 233 Broadway, New York City, describes and illustrates the Roller-Smith portable, direct-reading rail-bond testers, types "SBT" (standard sensibility) and "BBT" (high sensibility). The former is for use on electric railways employing the rail as the return circuit and is also used extensively in coal and other mines where the trolley type of electric locomotive is employed. The latter type is designed for use where the current in the rail is comparatively feeble or where such current is absent.

INSTRUCTIONS FOR SELLING LAMPS.—The National Lamp Works of the General Electric Company, Nela Park, Cleveland, is distributing its "Four Star Book" for 1926, which contains instructions for its agents relative to advertising and for merchandising electric lamps. It gives a complete picture of its consumer advertising for the year, offers practical suggestions for tying in with this advertising and building up lamp sales, and shows what it has in the way of material to assist the agents in merchandising lamps properly.

ELECTRIC FANS.—The Robbins & Myers Company, Springfield, Ohio, is distributing its miniature fan catalog, entitled "For Health and Comfort," in which it describes the various types of the "R & M" desk, wall and ceiling fans, including model 46, which is an entirely new fan for 1926.

INDUSTRIAL FUELS.—"Selection of Fuel for the Heat-Treatment of Metal" is the title of bulletin No. 269 issued by the W. S. Rockwell Company, 50 Church Street, New York City, and relates to industrial heating operations in the metallurgical, ceramic and chemical industries. A table of comparative cost per 1,000,000 B.t.u. at unit prices is given, and an example from practice, illustrating the economy of production over a period of years in the same plant with better methods of heating and handling, made possible by improved furnaces, is included.

ELECTRIC HEAT IN INDUSTRY.—The General Electric Company, Schenectady, N. Y., has issued bulletin GEA-261, entitled "Electric Heat in Industry," in which it deals with the advantages of electric heat for industrial applications, including the metal, ceramic, chemical and printing industries, heat-treating and finishing processes, etc.

CORK FOUNDATIONS. — The Cork Foundation Company, 315 Fifth Avenue, New York City, is distributing a pamphlet calling attention to the "Absorbo" cork foundation for motor generators, cylinder presses, paper cutters, air compressors, etc.

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

BELLOWS FALLS, VT. — The mills, power rights, etc., of the International Paper Company at Bellows Falls have been acquired by the International Hydro-Electric Corporation, New York City. Tentative plans are under consideration for additional power developments.

BOSTON, MASS.—Contract has been awarded the Edison Electric Illuminating Company of Boston to supply electricity for the new Statler Hotel, calling for a connected load of more than 2,000 hp. An auxiliary power plant of 1,000 hp. capacity will be installed by the owners of the hotel.

EVERETT, MASS.—Plans for rebuilding the oil refining plant of the Beacon Oil Company, recently destroyed by fire, include a power plant. The loss is estimated at $100,000.

MONTEREY, MASS. — Plans are under consideration by the Southern Berkshire Power & Electric Company, Stockbridge, for extending its transmission lines into Monterey. Street lamps are also contemplated for the town.

PORTSMOUTH, R. I.—Power house equipment and machinery will be required for the local lumber mill, now under construction for the Weyerhauser Timber Company, 220 Broadway, New York City.

Middle Atlantic States

ALBANY, N. Y.—Electric power equipment will be installed in the proposed local ice-manufacturing plant to be built by the City Ice & Fuel Company, Cleveland, Ohio, to cost about $200,000.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts Navy Department, Washington, D. C., until Feb. 9 for delivering storage battery testing outfits, and hydrometers, insulating material, welding wire and rods, copper, brass and steel wire, etc. at the Navy Supply Depot, Brooklyn.

BUFFALO, N. Y.—Plans have been filed by the Buffalo General Electric Company for an addition to its substation at 809 Perry Street, to cost about $50,000.

BUFFALO, N. Y.—The City Council plans to install electric lamps on about 25 miles of streets now furnished by gas lamps. The work will be carried out by the Buffalo General Electric Company.

CANDOR, N. Y.—The Binghamton (N. Y.) Light, Heat & Power Company has petitioned for authority to extend its transmission lines in the town of Candor, and also to furnish electric service to consumers along the highway between Owego and Candor.

CHILI, N. Y.—The installation of an improved street-lighting system on the main streets of the village is under consideration by the Village Board.

FALCONER, N. Y.—The installation of a fire-alarm system throughout the village, to cost about $5,000, is under consideration by the Board of Trustees.

MALONE, N. Y.—Application has been made by the Malone Light & Power Company to the Public Service Commission for permission to build an electric distribution system in Chateaugay, and to erect transmission lines through Burke and Chateaugay, and for approval of franchises granted in the three municipalities.

NEW YORK.—Bids will be received by the United States Signal Corps, Procurement District, Governors Island, until March 4, for 25 motor-generators; 25 panels, 50 armatures, 50 sets of bearings, 75 sets of coils, 50 sets of brush holders, 50 sets of brushes, and 25 condensers (Circular 22).

POTSDAM, N. Y.—Bids will be received by the Municipal Board of Potsdam until Feb. 25 for construction of filtration and pumping plant of 2,000,000 gallons per day capacity and for super and substructure for two 200-hp. hydro-electric units joined to filter plant. Separate bids will also be received at the same time for complete filter equipment, piping, pumps, motors, etc., for the above plant. Bogart & Pohl, 30 Church Street, New York City, are engineers.

WILLARD, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Feb. 24 for electric work and replacement of electric wiring at the Willard (N. Y.) State Hospital.

ALLENTOWN, N. J.—The installation of an improved lighting system on a portion of the Allentown-Yardville highway is under consideration by the Hamilton Township Committee.

ATLANTIC HIGHLANDS, N. J.—The municipal electric plant has been acquired by the Eastern New Jersey Power Company, Asbury Park, which plans to extend its transmission lines in this section. Improvements will be made to the local system.

BELVIDERE, N. J.—The New Jersey Power & Light Company, Dover, which has acquired the local plant, plans to extend its transmission system to Belvidere.

NEWARK, N. J.—The Public Service Electric & Gas Corporation has appropriated $1,285,000 for extensions in present substations and $2,000,000 for new substations which will be located at Bayonne, Jersey City, Paterson, Carteret, Union City and Monmouth Junction.

SPRING LAKE, N. J.—Bids will be received by the Mayor and Council of the Borough Council of Spring Lake until February 8 for furnishing material and construction of sanitary sewers, manholes and one electrically-equipped ejector station. John M. Braly is borough engineer.

BRISTOL, PA.—The Pacific Steel Boiler Corporation, Waukegan, Ill., plans to install electric power equipment at its proposed local plant, to cost about $300,000.

PHILADELPHIA, PA.—The Department of Wharves, Docks and Ferries plans to install electric power equipment at its proposed new pier on the Delaware River, foot of Jackson Street, to cost about $3,809,250.

PHILADELPHIA, PA.—Plans have been filed by the Philadelphia Electric Company for a machine and mechanical shop at Twenty-sixth and Christian Streets, to cost about $50,000.

COOPERS, W. VA.—Electric power equipment will be required for a proposed local power plant to be erected by C. B. Smith, in connection with a coal mining project.

LYNCHBURG, VA.—Plans for the proposed factory building of the Snidow-McWane Furniture Company, to cost about $50,000, include a power plant.

RICHMOND, VA.—The Virginia Electric & Power Company has appropriated $750,000 for the erection of a high-tension transmission line from Richmond to Fredericksburg.

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, United States Army, Washington, until Feb. 25, for a number of 5-kw. portable gasoline electric generator sets (Circular 4).

WASHINGTON, D. C.—Plans have been approved by the Chief of Engineers, United States Army, for the installation of three generators, automatic switching and other electrical equipment for the District of Columbia water supply system, and for a power house.

North Central States

ONAWAY, MICH.—Plans for rebuilding the plant of the American Wood Rim Company, recently destroyed by fire, with a loss of about $500,000, include a power house.

ADA, OHIO. — Extensions are contemplated by the Ada Water & Light Company, including increasing the output of its power plant, improvements to distribution system, possibly ornamental lamps, etc., to cost about $50,000.

AKRON, OHIO. — An expenditure of $2,500,000 is contemplated by the Northern Ohio & Traction Company during 1926. Of this amount $1,500,000 will be expended in the light and power division, which will include $350,000 for an addition to the South Akron substation and distribution lines, extensions of the underground systems in all directions, new transformers and equipment, rural-line extensions and rebuilding of lines in Akron.

CLEVELAND, OHIO. — The Cleveland Southwestern Railway & Light Company contemplates improvements to its lighting system, to cost about $50,000.

COSHOCTON, OHIO.—The construction of new substations and extensions to its transmission lines and distributing system, to cost about $275,000, are contemplated by the Ohio Service Company.

EATON, OHIO. — The Eaton Lighting Company contemplates an expenditure of $7,000 for extension of its distribution lines, etc.

GREENVILLE, OHIO. — Improvements, to cost about $25,000, are contemplated by the Greenville Electric Light & Power Company.

LIMA, OHIO.—Extensions are planned by the Northwestern Ohio Light Company, to cost about $240,000, including a new substation, high-tension transmission lines and addition to distribution system.

OBERLIN, OHIO.—Extensions to its distribution system, to cost about $12,000, are contemplated by the Ohio Electric Power Company.

SPRINGFIELD, OHIO.—Plans are under way by the Ohio Edison Company for construction of a new power plant, installation of new boilers at the old plants and extensions to distribution system, to cost about $1,750,000.

TOLEDO, OHIO. — Extensions and improvements are planned by the Lake Shore Power Company, to cost about $50,000.

PADUCAH, KY.—Work will soon begin on the construction of the power house unit of the new shops of the Illinois Central Railroad Company in Paducah.

BRAZIL, IND.—Plans for the proposed local brick manufacturing plant of the American Vitrified Products Company, Akron, Ohio, to cost $500,000, include a power plant.

EVANSVILLE, IND.—Bids, it is understood, will soon be asked by the Mead-Johnson Company, 200 St. Joseph Avenue, for equipment for an addition to its power plant including turbo-generator, ash and coal-handling equipment, stokers, condensing apparatus, etc., to cost about $90,000. W. E. Briggs, Holston Building, Knoxville, Tenn., is engineer.

INDIANAPOLIS, IND.—Steps have been taken for extensions and betterments in the street-lighting system in the Butler-Fairview districts by the Butler-Fairview Civic Association.

CHICAGO, ILL.—Plans have been approved by John T. Miller, commissioner of gas and electricity, for the installation of an ornamental lighting system on State Street between Lake and Van Buren Streets, to cost about $100,000, to be paid by the State Street Lighting Association.

CHICAGO, ILL.—Bids will be received by the United States Signal Corps, Procurement District, Chicago, until Feb. 16, for one motor-generator set, battery charging outfit, telephone storage battery (Circular 24).

CICERO, ILL.—Plans for the proposed plant of the Stromberg Motor Devices Company, 68 East Twenty-fifth Street, Chicago, to be erected at Fifty-fourth Avenue and Sixteenth Street, to cost about $3,500,000, include a power plant. Leiberman & Hein, 190 State Street, Chicago, are engineers.

DECATUR, ILL.—The Wabash Railroad Company, St. Louis, plans to install electric power equipment in connection with proposed additions to its local locomotive shops, to cost about $400,000.

DE KALB, ILL.—The installation of a new boiler and accessories, to cost about $127,000, at its local plant is under consideration by the Illinois Power Company, Springfield.

BLUE EARTH, MINN.—Bonds to the amount of $20,000 have been voted, the proceeds to be used to increase the output of the municipal electric light plant.

CROSBY, MINN.—The Minnesota Power & Light Company, Duluth, plans to install an improved lighting system.

MINNEAPOLIS, MINN.—Plans are under consideration by the Minneapolis Park Board for installing a new street-lighting system, at a cost of about $211,000. The plans provide for new lamps on St. Anthony Boulevard, from East Hennepin Avenue to the Mississippi River, Minnehaha Parkway, Godfrey Road and Minnehaha Avenue from East Forty-ninth Street to West River Road. A. C. Godward is city planning engineer.

ST. PAUL, MINN.—Plans are being prepared by G. M. Shepard, city engineer, for the installation of ornamental lamps on Aldine Street, between University and Shields Avenues.

GRANT, IOWA.—An electric franchise has been granted to J. W. White, Cumberland, to furnish service here. A transmission line will be erected from Cumberland to Grant. Bonds to the amount of $3,000 have been voted to build a municipal distributing system.

IOWA CITY, IOWA. — The Iowa City Light & Power Company plans extensions in its light and power system, to cost about $30,000.

BIRCH TREE, MO.—The Public Service Commission has granted the Southeast Missouri Public Service Company permission to construct and operate electric generating and distributing systems in Birch Tree, and also in Neeleyville and Naylor.

COLUMBIA, MO.—Preliminary plans are being prepared by the Missouri Farmers Association, Inc., for a cold storage plant, to cost about $150,000. H. A. Cowden is secretary.

MEXICO, MO. — Permission has been granted the Missouri Power & Light Company to erect a 33,000-volt transmission line from Bucklin to New Cambria (the present line to be abandoned), and to construct and operate branch lines from this trunk line to serve farmers and coal mines adjacent thereto; also to build a 32,000-volt line from Knox City to Newark and to erect and operate a distribution system in the latter town.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service until Feb. 16 for construction of a rapid sand filter at Howard Bend, St. Louis County, consisting of 20,000,000-gallon units together with controlling apparatus, wash water pumps and tanks, etc. Further information may be obtained at the office of the Water Commissioner, Room 312, City Hall.

COURTENAY, N. D. — The Otter Tail Power Company, Fergus Falls, Minn., plans to extend its transmission lines in this section, to cost about $75,000. Also to erect a transmission line to Pingree.

FARGO, N. D.—The City Council is considering a petition for installing ornamental lamps on Thirteenth Street, to cost about $17,000.

WISKEH, N. D. — The Krein Electric Company contemplates installing a 120-hp. crude oil engine and generator and also another unit of 60 hp.

HOT SPRINGS, S. D.—Bids will be received by the United States Veterans' Bureau, Room 791 Arlington Building, Washington, D. C., until Feb. 16 for a refrigeration and ice making plant, at the local United States Veterans Hospital.

WOONSOCKET, S. D. — Improvements contemplated by the Dakota Public Service Company, Sioux Falls, Iowa, include the erection of 55 miles of high-tension lines, rebuilding electric distribution systems in four towns, rebuilding telephone systems in two towns, installing additional engines in plants at Chamberlain and Mount Vernon, and new buildings in several towns.

COTESFIELD, NEB.—The City Council has plans under way for a transmission line for local light and power service. The Henningson Engineering Company, National Building, Omaha, is engineer.

MORRILL, NEB.—The Dutch Flats Electric Company, recently incorporated, plans to erect an electric transmission line from Dutch Flats to Morrill, a distance of 7 miles.

Southern States

SPINDALE, N. C. — The Elmore Company contemplates the installation of an electric power plant in its local mill.

BLOXHAM, FLA. — The West Florida Power Company, Tallahassee, has applied to the Federal Power Commission for a preliminary permit to build a dam and power station on the Ocklocknee River. Mees & Mees, Charlotte, N. C., are engineers.

GAINESVILLE, FLA.—Extensions are contemplated to the municipal electric light power house, and the installation of turbine generator, boilers, etc. The cost is estimated at $100,000.

OLDSMAR, FLA.—The local electric plant has been acquired by the Tampa (Fla.) Electric Company, which plans to build a substation and make connection with its transmission system.

SOUTH JACKSONVILLE, FLA. — The City Council has authorized the city properties committee to enter into a contract with the Board of County Commissioners for the use of the ornamental lamp posts in connection with extending the municipal electric transmission line along the Atlantic Boulevard, a distance of 4½ miles, beyond the present city limits.

CHATTANOOGA, TENN. — The Dixie Mercerizing Company plans to increase the output of the power plant at its Ridgevale mills.

LINDEN, TENN.—The Southern Cities Power Company, Chattanooga, plans to erect a transmission line from Columbia to Linden, where it has been granted a franchise. Work will soon begin on installing an electric distribution system here.

MANCHESTER, TENN. — Plans are under way by the Southern Cities Power Company, Chattanooga, for the erection of a transmission line from Manchester to Viola, via Summitville, to supply electricity in both towns. The company proposes to supply service to farms along the line.

LAKE CHARLES, LA.—The Board of Dock Commissioners plans to install electric power equipment at the proposed wharf, dock and warehouse, to cost about $500,000. The J. F. Coleman Engineering Company, New Orleans, is engineer.

ALINE, OKLA.—Plans are under way by the City Council of Aline for the erection of a transmission line from Fairview to Cleo Springs and to Aline, a distance of 35 miles, and a distribution system in Aline, to cost about $40,000. H. G. Olmstead, Oklahoma Building, Oklahoma City, is engineer.

MUSKOGEE, OKLA.—The Southern Ice & Utilities Company, Dallas, Tex., plans to install electric power equipment in connection with extensions to its local ice-manufacturing plants, to cost about $170,000.

REDLAND, OKLA. — Plans are being considered by the City Council to establish an electric system here. It is proposed to erect a transmission line, 10 miles long, to connect with the high-tension line of the Oklahoma Gas & Electric Company. The cost is estimated at $25,000.

AMHERST, TEX.—The Texas Utilities Company, Plainview, which has purchased the electric plants and systems of the Lamb County Utilities Company at Amherst and Sudan, and has obtained a franchise for a plant in Muleshoe, plans to extend its transmission lines to all these towns.

ASHERTON, TEX. — The City Council has granted the Texas Central Power Company, San Antonio, a franchise to operate an electric light and water plant.

KENEDY, TEX.—Plans are under way by the Texas Central Power Company, San Antonio to build a new thirty-ton ice plant, to cost about $50,000.

THREE RIVERS, TEX. — Plans have been announced for an expansion program, involving an expenditure of a large amount of money during the next four or five years, by the Texas Central Power Company, San Antonio, and the Central & Southwest Utilities Company, both subsidiaries of the Middle West Utilities Company, 72 Adams Street, Chicago. One of the proposed projects include the extension of a transmission system in northeastern Mexico

that may extend to Monterey, Victoria, Tampico and other cities. The plant to supply power for this system, it is understood, will be located at Three Rivers, which is in the heart of a natural-gas field. The proposed transmission system will also supply electricity to all towns on the American side of the delta of the Rio Grande.

Pacific and Mountain States

CASTLE ROCK, WASH. — The Spirit Lake Railway & Power Company, Portland, Ore., represented by R. W. Lincoln, 1106 Killingsworth Avenue, Portland, has secured permission to build a hydro-electric power development in this section, to cost about $2,000,000, with transmission system.

EVERETT, WASH.—The City Council has contracted with the Puget Sound Power & Light Company, Seattle, for extensions and improvements in the street-lighting system.

ILWACO, WASH.—The Ilwaco Light & Power Company contemplates extensions in its transmission system.

PRAIRIE CITY, ORE. — The Prairie Power Company has applied for permission to build a hydro-electric power development on Strawberry Creek, to cost about $650,000, including a transmission line.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Corporation plans to erect a substation at 5518 Western Avenue, to cost about $50,000.

LOS ANGELES, CAL.—The City Council has approved the installation of ornamental lamps on Figueroa Street, and on South Park Avenue, using pressed steel standards.

LOS ANGELES, CAL.—Bids will be received by the Water and Power Commission, 207 South Broadway, until March 2, for a steam-turbo generating unit, three boilers, etc., for the proposed municipal steam-driven power plant at Los Angeles Harbor. J. P. Vroman is secretary.

RIVERSIDE, CAL.—The City Council is considering the installation of ornamental lamps on Fourteenth and Market Streets, and on New Magnolia Avenue, from Main Street to Jurupa Avenue.

CHANDLER, ARIZ.—The City Council is considering the installation of a municipal electric plant. The Welland Engineering Company, First National Bank Building, Pueblo, Colo., is engineer.

KALISPELL, MONT.—The City Council is considering extensions to the lighting system in the downtown section.

Canada

CALGARY, ALTA.—The installation of a new bank of transformers at the Horseshoe power plant of the Calgary Power Company, to cost about $100,000, is under consideration. The company also contemplates the reconstruction of two of its power lines to carry 132,000 volts.

VANCOUVER, B. C.—Plans are being prepared by the British Columbia Electric Railway Company, Ltd., for the construction of a substation at Fifth and First Streets, to cost about $80,000.

MONCTON, N. B. — Extensions of the transmission line of the New Brunswick Electric Power Commission, St. John, from Moncton to Sackville and Hillsboro is under consideration.

TORONTO, ONT.—The Ontario Government has granted the Hydro-Electric Power Commission of Ontario permission to proceed with the development of the Alexander Falls power project on the Nipigon River. The plans provide for the development of 50,000 hp., to cost about $7,000,000.

WELLAND, ONT.—Plans are under consideration to extend the transmission line of the Welland Hydro-electric System from Burnaby to Wainfleet and possibly further north.

FARM POINT, QUE.—A second large water power development on the Gatineau River, to be located at Farm Point, about 40 miles from Ottawa, will be built by the International Paper Company, New York City. Part of the power generated by the plant will be used for the company's paper mill at West Templeton, Ottawa.

QUEBEC, QUE. — Permission has been granted the Duke-Price Power Company to erect a 154,000-volt transmission line between the hydro-electric developments at the Grande-Decharge and the industrial plants in the Lake St. John section of Arvida, where the Aluminum Corporation is erecting large plants.

Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 5, 1926)

1,568,042. INCLOSED SWITCH; H. M. Broadwell, Plainville, Conn. App. filed Feb. 27, 1923. Safety type with an externally accessible key-operated release member for retreating the movable part of the latch inside the box.

1,568,080. ELECTRIC WELDING; J. W. Meadowcroft, Philadelphia, Pa. App. filed May 18, 1922. For electrically spotwelding pieces of metal, particularly aluminum or alloys containing aluminum as the major constituent. The superposed pieces of metal to be united are interposed between sheets of resistance material, in which heat spots are generated by the passage of the welding current upon the application of the welding electrodes.

1,568,131. CABLE-BOX ANCHORAGE; W. A. Bonnell, Brooklyn, N. Y. App. filed Sept. 18, 1922. So designed as to be completely ready for installation and use as received from the foundry, also having means by which it may be firmly clamped upon a tubular support by a single accessible screw and co-operative nut in conjunction with an inclined element integral with the box.

1,568,156. MULTIPLE-PLUG RECEPTACLE; A. Herskovitz, New York, N. Y. App. filed May 2, 1924. Containing a plurality of plug jacks into which terminal plugs may be plugged for making electrical contact for conductor cords, and which may be plugged into a wall or floor receptacle of many of the ordinary types

1,568,172. THERMIONIC TUBE; F. S McCullough, Wilkinsburg, Pa. App. filed May 6, 1925. Cathode of which may be heated by alternating or pulsating currents, so that ordinary house-lighting current may be employed in the operation.

1,568,193. METHOD OF AND APPARATUS FOR WELDING; H. E. Snodgrass, Summit, N. J., and T. M. Hunter, Newark, N. J. App. filed March 24, 1922. In which a plurality of welding operations are simultaneously carried out with a single welding machine and the members to be welded are simultaneously prepared for welding. The apparatus can also shear one or more strips and thereafter form the strips into tubes and weld the edges, the entire operation being carried out at such a rate that the tube or tubes are brought to the welding point with their freshly sheared edges in weldable condition.

1,568,237. GENERATOR; L. M. Perkins, Syracuse, N. Y. App. filed Jan. 3, 1921. Third-brush, variable-speed type, in which it is possible to change to a certain extent the characteristic curve to meet particular conditions, as, for instance, to increase the ampere output under higher speed.

1,568,262. DYNAMO-ELECTRIC MACHINE; C. O. Bergstrom, Boston, Mass. App. filed Aug. 29, 1922. Repulsion-induction motor mechanism for short-circuiting the commutator of such machines.

1,568,304, 1,568,305. MAGNETIC COUPLING; E. T. Williams, Brooklyn, N. Y. App. filed June 1, 1922. For compressors, blowers, exhausters and the like, in which a driving shaft extends out of the machine for connection with an external shaft, and which is arranged to prevent leakage out of or into the machine or casing.

1,568,345. THERAPEUTICAL LAMP; F. W. Robinson and K. V. Knapp, Newark, N. J. App. filed Feb. 1, 1924. In which the light is caused by an electric arc within a vacuum tube containing mercury, having a bi-lobed or tri-lobed tube composed of quartz glass, its upper portion, in which the arc takes place, being incased in a transparent envelope, provided with reflecting surfaces except at the front, each lobe being independently connected with one of the lead-in terminals of an electric circuit.

1,568,366 TESTING TOOL FOR INSULATOR; M. de Micheli, Genoa, Italy. App. filed June 21, 1924. Essentially consists of an electroscope in which the gold leaves are replaced by an oscillating lever. The electric charge is communicated to the tool by means of a device consisting of a rotatable part and a stationary part forming elements of the tool. An indicator connected with the oscillating lever co-operates with a graduation to point out the degree of insulation of the material under test.

1,568,474. APPARATUS FOR EFFECTING THE AUTOMATIC CONNECTING AND DISCONNECTING OF ELECTRICAL MACHINE UNITS; F. Schmidlin, Baden, Switzerland. App. filed Aug. 7, 1922. Effected in dependence upon the network current automatically by means of thermal relays which are energized by the heating due to the network current.

1,568,478. GENERATOR; E. D. Smith, Rochester, N. Y. App. filed Oct. 22, 1923. Constant-voltage machine for the charging of storage batteries and other analogous uses, also arranged for automatically increasing the field strength of the generator as the load increases, while preventing decreasing the field strength beyond a predetermined fixed point that is but slightly below normal.

1,568,508. SWITCH ATTACHMENT; E. Johnson, Warren, Ariz. App. filed May 27, 1922. For switches of the flush type by means of which the switch may be operated from either side of the wall with equal facility and convenience.

1,568,584. ATTACHMENT PLUG; J. C. Blankenship, Austin, Tex. App. filed July 16, 1924. Having a baseboard receptacle for receiving a removable plug with a three-way circuit for electrical attachments embodying the use of a three-way circuit.

1,568,585. ELECTRIC WIRE CONNECTOR; L. J. Brune, Sr., Algiers, La. App. filed Sept. 11, 1924. Comprising a sleeve having an insulating covering, which sleeve is provided with instruck oppositely disposed teeth adjacent to its ends, adapted to bite into electric wires forced into the ends of the sleeve and to hold the wires against outward movement.

1,568,593. ELECTRIC GRILL; M. F. Fitzgerald, Winsted, Conn. App. filed Aug. 13, 1925. Method of supporting the heating element to avoid losses of heat by conduction.

1,568,603. ATTACHING DEVICE FOR ELECTRIC CABLES; C. E. Hartvig, El Reno, Okla. App. filed March 3, 1922. Whereby electric cables, particularly cables having a metallic armor, may be secured in place without danger of the development of grounded or shorted circuits, so that such cables may be advantageously used in connection with the wiring for railway signaling and switching systems.

1,568,644. TERMINAL CONNECTOR; E. Waller, Detroit, Mich. App. filed Oct. 28, 1921. For use with cables having comparatively large current-carrying capacity, as for storage-battery terminals.

1,568,675. SHORT CIRCUITER FOR ELECTRIC MOTORS; E. P. Larsh, Dayton, Ohio. App. filed Oct. 20, 1923. Embodies in a single structure the advantageous features of both the governor weight and garter-spring type of short-circuiting devices as well as the advantages of both the butt contact and the wiping contact.

1,568,676. KNIFE-BLADE SWITCH; H. E. Leppert, New Britain, Conn. App. filed Oct. 6, 1924. Quick-break switch of the safety type, the switch jaws having a buffer which can be readily applied to standard-type switches.

1,568,682. COMMUTATION; F. S. Marcellus, Amsterdam, N. Y. App. filed Oct. 9, 1923. Commutation device for dynamo-electric machines and in particular for machines of the instrument class, where variation in voltage at the commutator brushes is decidedly objectionable.

1,568,692. DYNAMO-ELECTRIC MACHINE; A. A. Pollock, Leamington Spa, England. App. filed March 19, 1925. Division of the current, where the current per circuit is large, effected by providing an armature winding comprising coils in each of which the current in one conductor is divided into two and returns through two conductors which are in parallel and situated 360 electrical degrees apart.

1,568,694. PHOTO-ELECTRIC DEVICE; W. A. Ruggles, Schenectady, N. Y. App. filed April 16, 1921. Electrode of improved sensitivity by depositing a film of metal in a vacuum to serve as a conductive base for the light-sensitive metal, which preferably is deposited likewise in a vacuum upon the conductive foundation surface.

1,568,695. CASCADE INDUCTION-MOTOR REGULATION; W. Seiz, Baden, Switzerland. App. filed Aug. 21, 1922. The series transformer is placed in the primary circuit of the motor and the secondary of this transformer is connected through a frequency converter to the exciting system of the commutator machine. The voltage induced in the secondary winding of the series transformer is proportional to the watt current and thus to the torque of the motor. This secondary voltage of a transformer so connected may be made proportional to the slip by means of an adjustable resistance connected in series with the secondary circuit of the transformer.

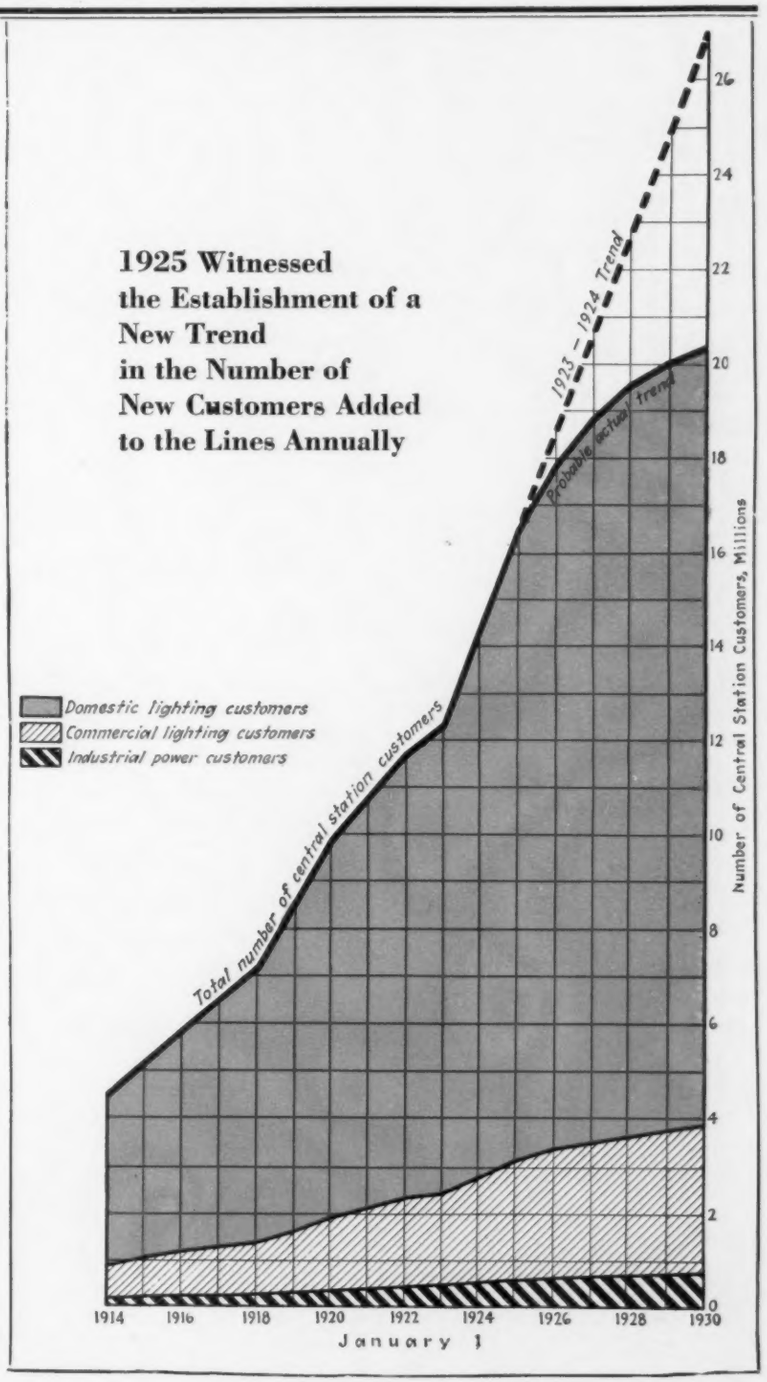
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Industry Passes Another Milestone

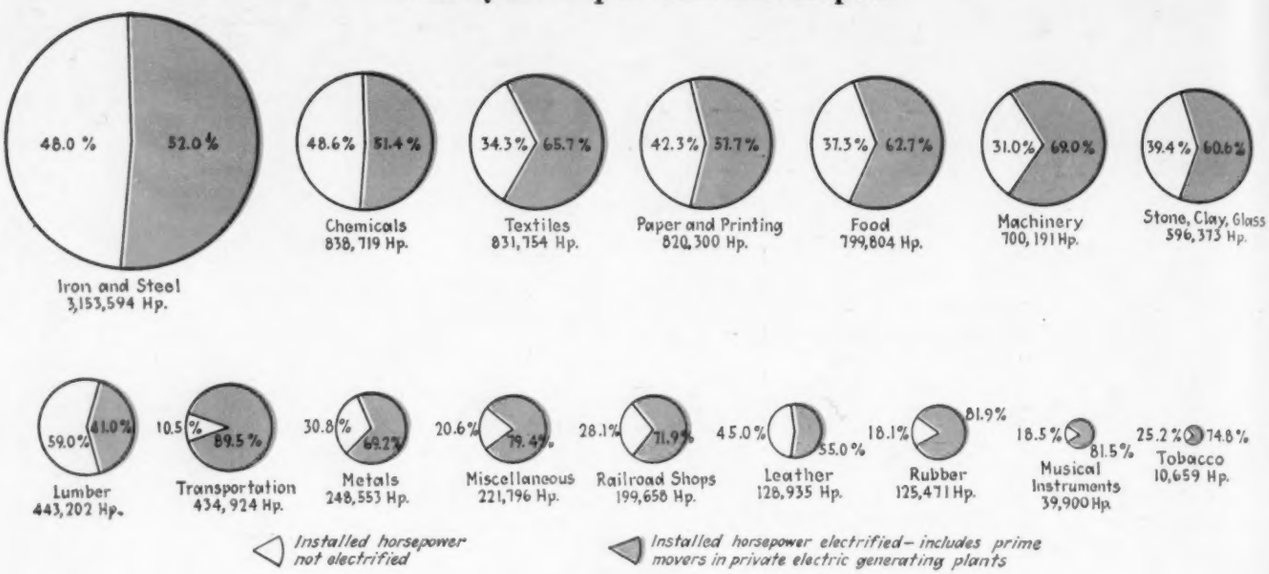
AMONG the many basic factors underlying the marvelous development of the American electric light and power industry, especially since the war, building construction has played a very conspicuous part. Domestic and commercial building was materially below the estimated normal from 1917 through 1921. This subnormal construction activity resulted in a severe shortage of both domestic and commercial structures. The tide turned during the summer of 1921, since which time building construction has been materially above the estimated normal. Many students of the industry believe that the housing shortage has now been wiped out and that the industry will soon return to the normal trend of construction. The normal trend of building is fairly well defined, and it would appear that the cumulative abnormal volume of construction since 1921 has exceeded the accumulated deficiency from 1917 through 1921.

But in addition to the gradual elimination of the housing shortage the fact must also be remembered that approximately 55 per cent of the population of the country is now living in electrically lighted dwellings, while only 51 per cent of the population of the country is living in cities and towns of more than 2,500 population. This fact, in addition to the fact that the old houses are fast becoming wired, makes certain a material decrease in the number of customers added to the lines annually in the years to come. In fact, the reports received for 1925 indicate that this trend has already set in, the number of customers taken on the lines during the past year being about 700,000 under the number taken on the lines during 1924. Many large cities reported a decrease during 1925 of 40 per cent under the number of customers taken on the lines during 1924, and nearly all cities and towns, both large and small, reported a material decrease under 1924. But it was hardly to be expected that the taking on of more than 2,000,000 customers per annum, as in 1923 and 1924, could last indefinitely. There is an economic limit to any type of growth. The normal number of homes constructed per annum is only around 200,000, and a large proportion of these are in country districts. The industry must expect to have the number of customers annually taken on the lines reduced to around 200,000 in due course of time, although many years will elapse before the annual growth will sink to this figure.



In other words, the industry has passed another milestone in its development. The first half of the decade was devoted very largely to the adding of new service connections to the lines, the load per customer being largely neglected. The later half of the decade will emphasize more strongly the increased consumption per customer. The slogan of the industry has changed from "More customers" to "More consumption per customer."

The Central-Station Potential Industrial Power Field of the Atlantic States Is Only 37.4 per Cent Developed



Power Potentialities in the Middle Atlantic States

THERE are two potential fields for the general development of the electrical industry outside the economic progress possible within the industry itself. One of these is by increasing the number of customers and the other is by increasing the consumption per customer. The number of customers possible of future electrification is limited, and it must be expected that from now on growth in this direction will be confined to narrower and narrower limits until the number of customers taken on the lines annually balances with the normal growth in population and general industry.

But in the field of increased consumption per customer there is a source of possible growth the size of which gives room for central-station expansion for a great many years to come. The fact that the industries of the Middle Atlantic States are 59.6 per cent electrified does not tell the whole story of the present and future industrial load of the central stations operating in that section. Almost 37.3 per cent of this electrification is from private electric generating plants, one industry in this section, the iron and steel industry, reporting a 69 per cent electrification from private plants. This fact indicates that only about 37.4 per cent of the present primary power of the industrial plants of the Middle Atlantic States is electrified from central-station generating plants.

In addition to the potential central-station industrial field in this section being only slightly more than one-third developed, the fact must also be remembered that new industrial applications of electrical energy are being discovered and put into practice in many plants. The use of electrical energy for industrial heating purposes and in electrolytic and electrochemical processes has been touched only slightly thus far, the future offering a field for possible development of the industrial heating load which greatly exceeds the present motor load of the central stations.

Although the industrial plants of the Middle Atlantic States taken as a whole are estimated to be 59.6 per cent electrified, yet some of the primary and largest industries of the section offer a still larger field for future electrification. The principal industry of this section is the iron and steel industry, accounting for one-third of the primary power of the section. These mills, however, are only 52.0 per cent electrified, according to a survey recently completed by the ELECTRICAL WORLD. This degree of electrification is below that reported by this industry in any other section of the country, excepting the South Central States. New England reported a 75.3 per cent electrification of the iron and steel industry, the South Atlantic States 74.2 per cent, North Central States 53.0 per cent and the Mountain-Pacific States 68.4 per cent. In the iron and steel mills of the Middle Atlantic States is to be found an unusual field possible of development electrically.

The industrial plants of the Middle Atlantic States present an opportunity for future central-station power development unrivaled in any other section of the nation. The power engineers of the central-station companies operating in this region have accomplished their work well, but the future holds out even greater possibilities for employing the selling abilities of these power engineers. The past is but an indication of that which can be accomplished in the future.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.